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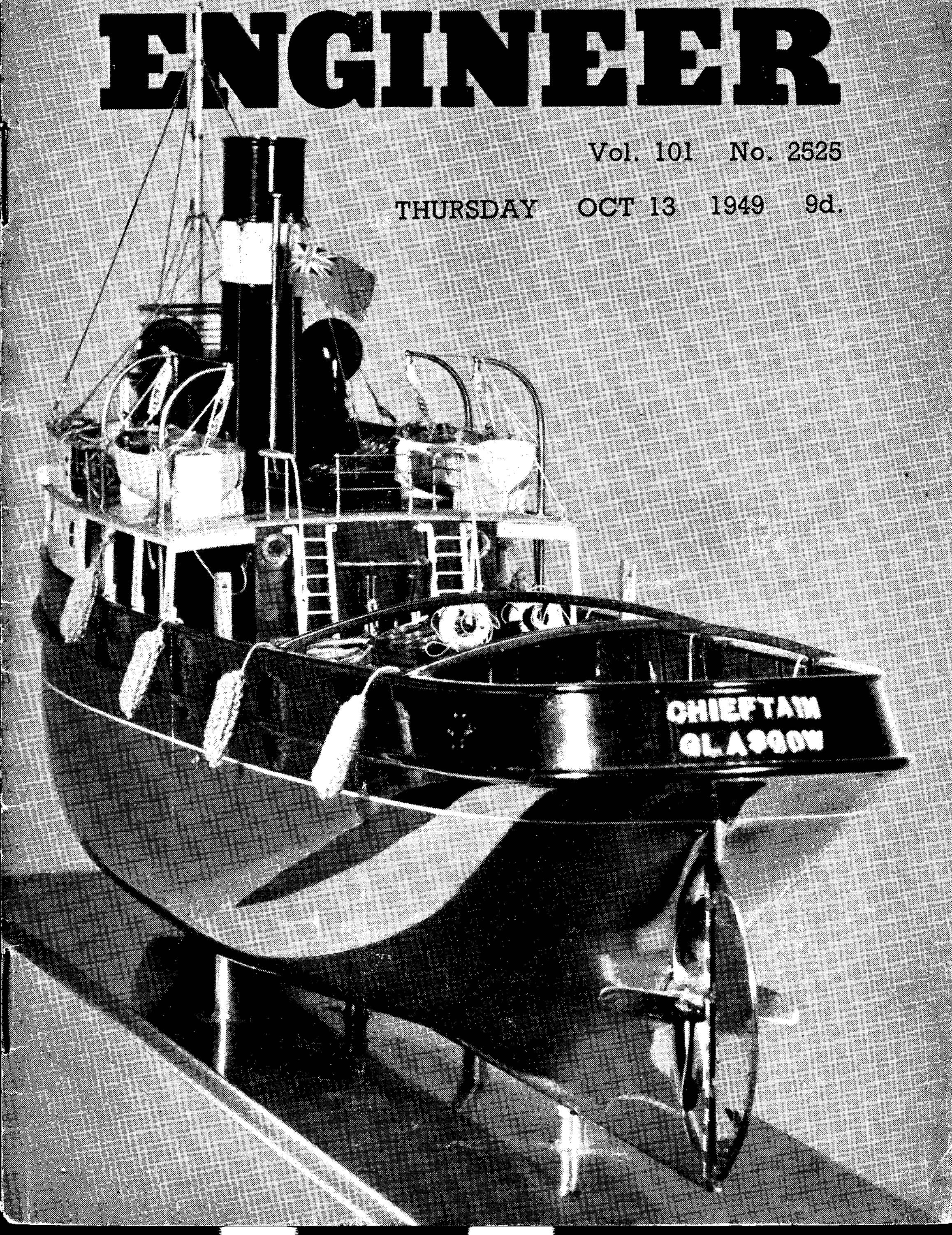


The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

13TH OCTOBER 1949 VOL. 101 NO. 2525

SMOKE RINGS

Our Cover Picture

● THE SUBJECT of our cover picture this week is the very fine model tug *Chieftain* made by Dr. Fletcher, of Colne, which won the Championship Cup for steamship models in this year's "M.E." Exhibition. The hull was built of wood, planked on frames and beautifully finished inside and out. Some said the finish was too good for the type of vessel, but the impression given by even a tug, fresh from the builders' hands, when everything is newly painted and polished, is very different from that given after it has been in service for some time. Dr. Fletcher's tug will no doubt lose some of its spick-and-span appearance after it has had a few trips on the pond—or wherever it is he sails it. The power plant consists of a return-tube boiler, a vertical compound engine with a special type of reversing gear, a condenser, and a Weir type boiler feed pump. The layout is very clean and everything is accessible. The finish of the power plant equals that of the hull and everything confirms our impression that Dr. Fletcher is an expert craftsman in both wood and metal, which, to say the least, is unusual.

Evening Classes in Model Engineering

● WE LEARN from the Welling & District Model & Experimental Engineering Society that they are holding an evening class in conjunction with the Erith Technical College each Monday evening, from 7 to 9 p.m. The class is not restricted to members of the Society. It has recently been decided to set aside a sum of money to assist the purchase of tools by members and a tool club has been started by the Society. Members may buy tools by subscription, either before or after purchase, and at the moment, it is being tried out experimentally for a provisional period of three months. We heartily commend both these schemes to our readers, and particularly organisers of model engineering societies. Any further information regarding these schemes can be obtained from the Secretary of the above society, Mr. J. A. King, 150, Sutherland Avenue, Welling, Kent.

At Long Last

● THE INAUGURATION of the electric train services between London (Liverpool Street) and Shenfield by Mr. Alfred Barnes, Minister of Transport, on September 26th, recalls the fact that the general scheme for the electrification of this particular length of the old Great Eastern Railway was being investigated and discussed as far back as 1900. Therefore, just on fifty years have passed before the scheme could be brought into operation, and the chief reason why such a long time has been required remained unchanged until about fifteen years ago; it was the extreme difficulty, if not the actual impossibility of electrifying the line without drastically curtailing, or even withdrawing the passenger train services over the route, and this was, of course, unthinkable.

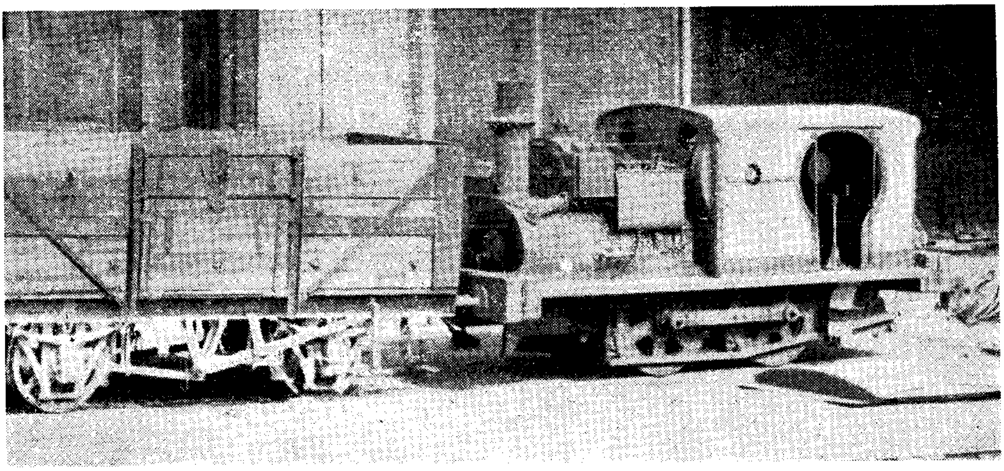
In 1900, the main idea behind the electrification scheme was a general speed-up of what was, even then, the most intensive suburban service in the world, especially at the morning and evening rush hours. Mr. James Holden, Locomotive Superintendent of the G.E.R., would seem to have been of the opinion that, if a speed-up was all that was wanted, a steam locomotive could be designed to do the job ; so, with the collaboration of his chief draughtsman, Mr. Russell, he prepared a design for a huge, 3-cylinder 0-10-0 well-tank engine which, on test, was found to be easily capable of equalling, if not improving upon the acceleration and haulage power of the much-vaunted electric motors. The result of this was that the electrification scheme was shelved ; but, because the 0-10-0 steam locomotive was far too heavy for the under-line bridges between Liverpool Street and Stratford, no more of the type were built, and the solitary example was withdrawn.

Thenceforth, from time to time, further consideration was given to the electrification problem, especially to the ways and means of putting it into effect. The only possible way appeared to be the construction of a new line either above or below the existing one from Liverpool Street to Stratford, and a scheme was drawn up for providing an underground railway to which the traffic from Liverpool Street could be diverted while the electrification of the existing line was in hand. The 1914-1918 war caused this scheme to be abandoned ; after that came the upheavals caused by the grouping of the railways in 1921 and the general depression in world affairs some ten years later.

Eventually, London Transport decided to extend the Central London line at each end ; the western end from Acton to Ruislip, and the eastern from Liverpool Street to Stratford. This provided the opportunity, at long last, for putting in hand, preparations for electrifying the L.N.E.R. line between Liverpool Street and Shenfield. The work was badly impeded by conditions brought about by the 1939-1945 war ; but it has now been finished, and a gradual change-over from steam to electric train operation is scheduled to be completed by November 7th.

We shall be very interested to note, in due course, what differences the electrification will make to the overall times of the services provided ; so far, railway electrification in this country, with the exception of the Metropolitan and District lines of London Transport, has made little, if any difference to journey times ; for example, the electric trains to Brighton are still allowed one hour for the trip, a time which presented no difficulty to by no means the most modern of L.B. & S.C.R. locomotives.

Another question, to which only time will provide a definite answer is : Will the new electric trains entice modelmakers to build models of them by the hundred ? Even after allowing for the fact that these new trains represent all that is best and most up to date in multiple-unit electric train design, we have our doubts as to what will prove to be the answer to that question !



A Gasworks "Pony"

● OUR PHOTOGRAPH shows an example of the one-time fairly numerous Aveling & Porter geared locomotives built for shunting in the yards around factories, gasworks and other industrial premises. This particular one has been known to us, by sight, for several years, for it belongs to Slough Gasworks and, until fairly recently, was frequently in use. During last May, however, it ceased work and was not seen again until Saturday, July 30th, when our photograph was taken, the opportunity being quite unexpected.

The engine is in the most deplorable state of filth and decrepitude, and it will probably never work again. We have been unable to discover when it was built, or how long it has been at Slough ; but, at the moment of writing it can be seen from the lane which passes the east side of the gasworks, from which point of vantage we secured our picture. The amount of protection provided for the driver, in proportion to the size of the engine, is interesting !

The Blackheath Regatta

(Above) *Mr. A. A. Rayman's flash steamer makes its first run*

(Left) *Mr. J. Jepson starts " Darky " in the steering competition*

THE annual M.P.B.A. regatta of the Blackheath Model Power Boat Club, held on Sunday, September 11th, was the last " full scale " regatta of a very successful season for model power boat enthusiasts, and this regatta proved to be as interesting and exciting to watch as any of the previous ones.

Among the highlights of the day's activities were—the raising of the Class " B " record again by Frank Jutton with his flash steamer, this time to nearly 54 m.p.h. ! A fine effort by B. Miles with his " supercharged twin " hydroplane *Barracuda II*, which nearly equalled the Class " A " record, and in the steering competition a feat was accomplished which is rarely seen these days, 3 bulls. This has been scored on only one other occasion since 1939.

The venue of the regatta was the Princess of Wales Pond, Blackheath, and well before the starting time, spectators and competitors arrived in large numbers. The weather was fine apart from a breeze, which did not, however, cause the water to be choppy.

The programme commenced promptly with the nomination race over 50 yd. and some 27 boats took their turn across the pond ; only about two boats failed to get across in style, and this appeared to be a good augury for the steering event which was to follow later.

The estimated times were not as close as is sometimes the case, the best to the actual run was that by J. Benson with *Comet*, 0.9 sec. error, the runners-up were Messrs. B. Whiting and E. Walker with *Ann* and *Coron* respectively.

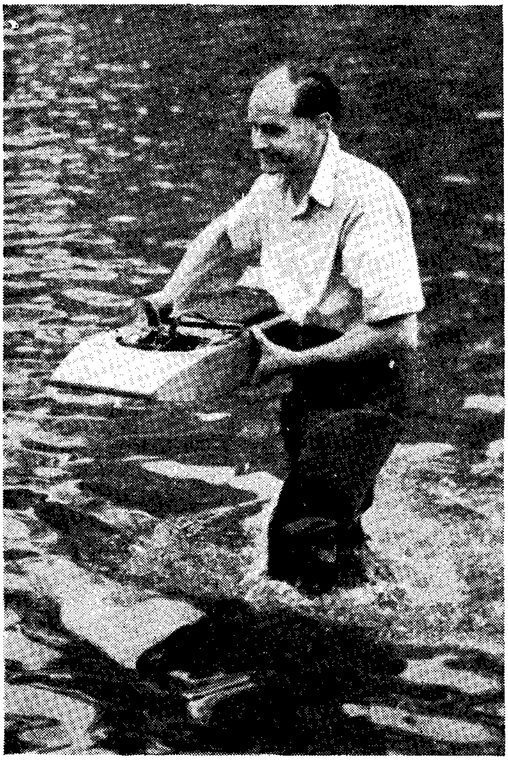
Result :

		error sec.	per cent.
1st.	J. H. Benson (Blackheath) *Comet*	0.9	10
2nd.	B. Whiting (Orpington) *Ann* ..	2.1	12
3rd.	E. Walker (Malden) *Coron* ..	1.3	13

(Results by per cent. error)

Two speed events were next, these being 300 yd. races for Class " C " and " C " restricted hydroplanes.

In the " C " restricted race, A. Stone (S. London) with his 10 c.c. " McCoy " engined



Mr. A. W. Cockman makes a welcome reappearance with " Ifit VI "

boat showed his best regatta performance to date with a fine run at 46.5 m.p.h. On his second run, exactly the same time was recorded—an unusual occurrence.

Of the four entries in the Class " C " race only A. Weaver (Victoria) with *Wizard of Oz* completed the course. J. Benson with *Moth* had capsizes on both runs while B. Miles (Malden) failed to get a run at all, the engine stalling on all four " releases."

Results :

" C " Restricted.—300 yd. Race

	sec.	m.p.h.
1st. A. Stone (S. London) *S6.* ..	13.2	46.5
2nd. C. Hancox (Kingsmere) *KM3.*	24.1	25.5

Class " C " Race

1st. A. Weaver (Victoria) *Wizard of Oz*	20.7	29.7

Following a short lunch interval the programme was continued with the Steering Competition, and one of the earlier boats to run scored a " maximum " 3 bulls. This was J. Benson's *Comet* of the Blackheath Club. This was the first time that this boat has achieved the " hat-trick," and it is also the first to be scored on the Princess of Wales Pond! The succeeding competitors were not at all deterred, however, and made good efforts to repeat the performance. A. Rayman, with *Yvonne,* also of the home club, scored a bull and two inners, while Messrs. A. Curtis (S. London), Mitchell (Victoria), Shepherd (Enfield) and Vanner (Victoria), all tied for third place, with 8 points. G. Mitchell was the successful winner of the re-run for third place.

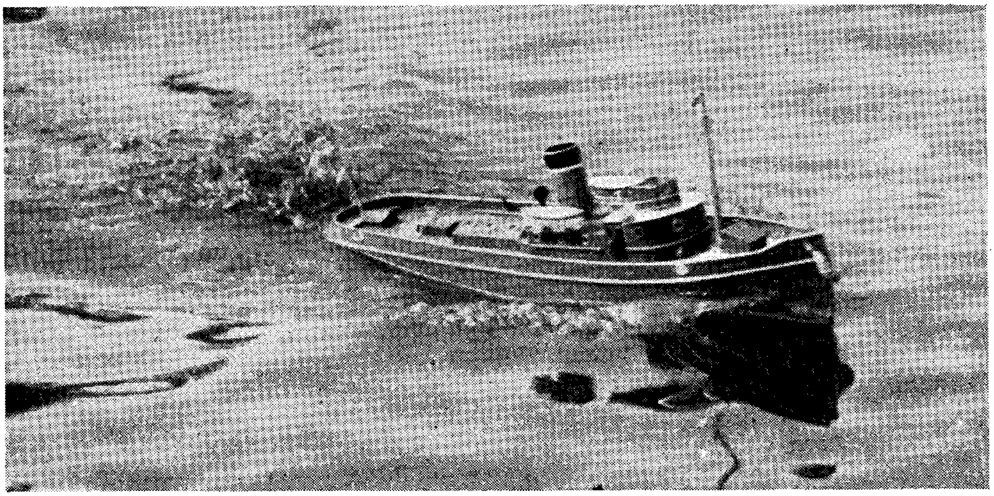
Result :

Steering Competition

	pts.
1st. J. H. Benson (Blackheath) *Comet* ..	15
2nd. A. Rayman (Blackheath) *Yvonne* ..	11
3rd. J. Mitchell (Victoria) *V20.* ..	8

In the 300 yd. Class " B " race, the amazing performance of F. Jutton's flash steamer *Vesta II* rather overshadowed the other boats ; on the first run over 52 m.p.h. was recorded, and this was bettered on the second attempt, raising the speed to 53.8 m.p.h. The running of *Vesta II*

(*Continued on page* 468)

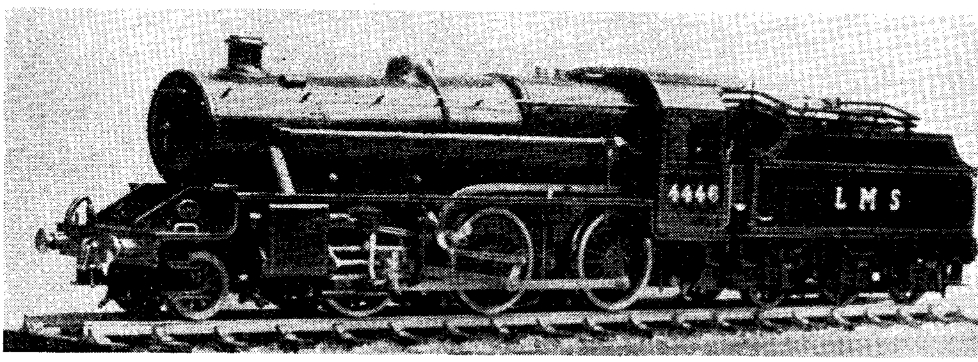


Mr. Perkins's petrol-driven tug " Canda " under way

LOCOMOTIVITIS
Or the Tale of a "$2\frac{1}{2}$-in."

by J. M. Ball

ONE reads reports of marvellous new cures and new remedies being brought to light by our tireless doctors and scientists, but it is doubtful whether that august body of men and women will ever find a complete cure for the distressing complaint named above. The sufferer



is easily recognised—the suddenly raised head at the sound of a locomotive whistle—the agonising paralysis which sets in if the victim happens to be passing a railway line when a train is due, but a bit late—the poor fellow who buys an expensive model railway " just for the kiddies, you know."

Some little relief can be enjoyed by the sufferer if such " appliances " as saws, files, a lathe, etc., are put within reach of his restless fingers ; but don't be led away with the idea that it's a cure ! The man may spend years constructing and running his own railway, but he'll still want to make another one—a bigger one probably.

The particular " germ " responsible for all this unrest first acquired " running powers " over my own " system " as far back as the first world war ; but, although I have always had access to a fair shop full of tools, the bare thought of ever being able to make a *real* locomotive seemed hopeless, until one day I visited a models exhibition in a neighbouring town and saw " IT," in the form of a particularly well-made " Dyak " chassis. I couldn't but admire its amazing simplicity—I felt just like the fellow depicted in the Road Safety poster—the " Germ " or " Jimp " said : " Go on, you'll do it easily " ; and so a start was made.

The prototype chosen was the L.M.S. Class " 5F " Mogul ; I chose this particular type chiefly because I dislike engines with sloping cylinders and motion. It is made to the scale of 17/32 in. to the foot.

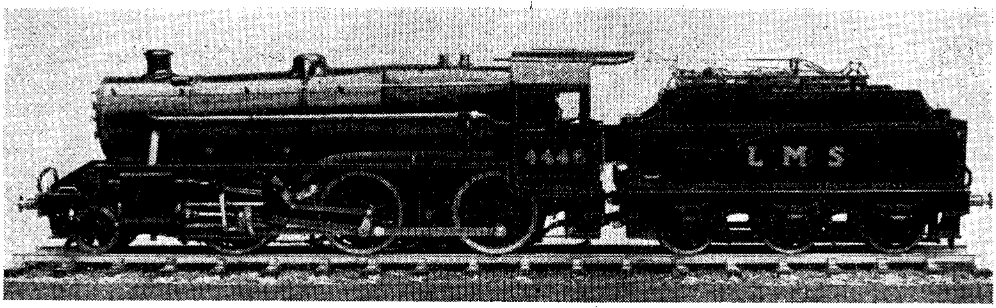
The boiler was made first, completed even to its lagging and all fittings and mountings, and I can thoroughly recommend this procedure, as it is great fun getting up steam, even though there are no wheels to go round. (Never mind the Missus and her caustic remarks about " never growing up " or " that ironing board you promised to make.") The boiler was mainly silver-soldered, but with all the final leaks caulked with soft solder.

Cylinders are of the built-up type, silver-soldered together and are $\frac{13}{16}$ in. bore by $1\frac{1}{4}$ in. stroke. An axle-driven pump, $\frac{13}{16}$ in. bore by $\frac{3}{8}$ in. stroke, looks after the boiler " thirst " ; but see last para. Cylinder drain-cocks operated from the cab are fitted, as also are steam brakes, though only to the drivers and the rear coupled wheels. Sand boxes and pipes are only dummies, but add greatly to the appearance.

The driving and coupled wheels offered some little difficulty, as 17-spoked wheels were called for and two sizes of balance-weights. This difficulty was overcome by making a boxwood pattern. Seven wheels were cast for me, all minus balance-weights ; each casting was then laid flat on a piece of asbestos and the gaps between the spokes were filled in with clay except where I wanted the balance-weights. Printers' type-metal was then run in to form the various shapes of weights required. The wheels were then turned up in the usual way, not forgetting to " show a tyre " !

Boiler barrel is $2\frac{7}{8}$ in. diameter outside at smokebox end and is parallel ; only the lagging is tapered, as this saves a lot of work and is, in the writer's opinion, stronger.

Eight $\frac{3}{8}$-in. tubes and one $\frac{3}{4}$-in. superheater flue are fitted. The regulator is of the well-known disc-in-a-tube type and draws its steam from a fountain or turret under the cab roof.



The Walschaerts valve-gear is fairly complete in detail, as will be seen. Valve crosshead guides are fitted, as well as proper double-grooved expansion-links supported on twin trunnions; most places requiring oil are fitted with brass oil-cups, even on the small anchor-links.

Reversing is carried out by means of an L.M.S. "handwheel" operating a square-threaded screw $\frac{3}{16}$ in. diameter. Lubrication is attended to by one of "L.B.S.C.'s" flat-type oil-pumps.

The tender is fitted with working brakes, emergency hand-pump, leaf-springs and a working water pick-up.

Proper double coal doors or "gates," including the usual securing bars and catches, complete the footplate fittings. The floor of the cab is chequered and has a flap covering the gap between engine and tender; also, there are spring-loaded doors at the sides. The rivets, of which there are hundreds, are dressmaker's steel pins suitably annealed. Safety-valves blow at 80 lb.

This engine was completed in three years of spare time, and my friends and I spent many happy hours in driving it on over 100 ft. of "up-and-downer."

Then came the day when, owing to the axle-pump eccentric set-screw working loose, I boiled the boiler dry. The first intimation I got was when one of the soldered-on handrail knobs suddenly became "air-borne." In my excitement I grabbed the tender hand-pump handle—it was just about the worst thing I could have done (and might easily have been the last !). The first stroke turned the boiler into one of the flash variety. The pressure-gauge needle made one quick journey to the 120 end; then my soft-solder caulking came out in large and bitter "tears." Did I weep? No—I soldered on the handrail knob and started straight away on a "$3\frac{1}{2}$"—that's all.

The Blackheath Regatta

(*Continued from page* 466)

at over 50 m.p.h. is wonderfully steady without the least sign of bucking or snaking about.

The runner-up was G. Lines (Orpington) with *Sparky*, and although stalling on the first run, a second try by this boat resulted in a run of over 40 m.p.h.

Result :

300 *yd. Class* " *B* " *Race*

		sec.	m.p.h.
1st.	F. Jutton (Guildford) *Vesta II*	11.4	53.8
2nd.	G. Lines (Orpington) *Sparky*	15	40.8

The last event of the day was a 500 yd. Class "A" race, and this produced some six boats, among which were two by B. Miles (Malden) *Barracuda II* and a new boat *Typhoon*; the latter boat has a lightweight two-stroke engine which has enormous intake and exhaust porting. This boat had not been actually run prior to this regatta, and it caused no surprise when *Typhoon* capsized at over 40 m.p.h., incidently choosing the precise spot where its owner was standing and giving him a free shower bath ! A very good run was put up by a very well-known flash steamer, A. Cockman's *Ifit* 6, now back in racing events after rather bad damage at Guildford in 1948. It was interesting to compare the smooth running of this boat (which still has the original submerged drive) with some of the more hectic surfacing jobs. *Ifit* 6 did 43.4 m.p.h. which is nearly up to its best performance.

Most of the other boats were a bit off form, with the notable exception of B. Miles's *Barracuda II*, which on a second run very nearly equalled the Class "A" record ; 55 m.p.h. was averaged over the 5 laps ! A fine performance, and the highest speed recorded to date in a M.P.B.A. regatta.

Result :

500 *yd. Class* " *A* " *Race*

		sec.	m.p.h.
1st.	B. Miles (Malden) *Barracuda II*	18.6	55
2nd.	A. Cockman (Victoria) *Ifit* 6	23.6	43.4

During the speed events, and unknown to the various competitors, the times taken to start after hooking on the line were being noted, and a special mystery prize was given to the quickest actually to commence the run at the $\frac{1}{2}$ lap. This was won by G. Lines (Orpington) who took only 38 sec. from the moment of hooking on.

*Voltmeters, Ammeters and Ohmmeters

by A. R. Turpin

TO measure a.c. current, we need a metal rectifier because the instruments of the moving coil type are unidirectional; these are made especially for the job, and can be obtained to suit instruments with F.S.D.s from 100 micro/amps to 25 milliamps. The smaller type up to 250 micro/amps size are made as half-wave rectifiers, and four must be connected as a bridge when used switches of the wafer type to transpose the connections as required, but personally I prefer to have separate instruments for each purpose, and I have constructed the three shown in Photo No. 3. The left-hand one is an a.c./d.c. voltmeter, reading 0-15, 0-150 and 0-600 V, a.c. and d.c. The next is an ohmmeter with four ranges measuring from a fraction of an ohm to

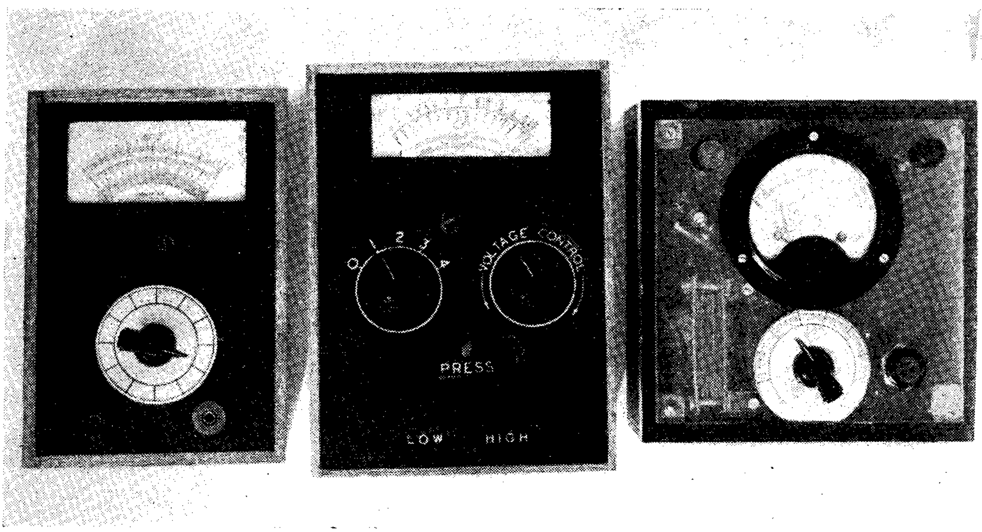


Photo No. 3. Home-made multi-range voltmeter, ohmmeter and ammeter

for this purpose. The larger sizes are internally connected as bridges, and can be connected as shown in Fig. 1 " E." " C," Photo No. 2, shows a small and a large type instrument rectifier. The chief difference when using the meter for a.c., is that the voltage measured is the R.M.S. voltage and 1 V on the scale d.c. will indicate 1.11 V a.c., or 1 A d.c. will indicate .9 A a.c. This can be allowed for either by drawing a new scale or varying the size of the series resistances so that the scale reads correctly.

When we come to a.c. ammeters, things are not quite so simple because these rectifiers cause considerable distortion when we start measuring millivolts, and when we shunt a milliammeter we are really measuring the millivolts across the shunt, so these are ruled out. We can still measure large a.c. currents by using a current transformer. Such a piece of apparatus is shown at " D," Photo No. 2.

It is quite possible to use only one meter to carry out all the foregoing functions using 500,000 ohms, which range can be still further increased by using an additional external battery. The right-hand meter is an ammeter giving the following ranges, a.c. .025, .25, 2.5 A, and d.c. .001, .01, .1, and 1 A, the range can be still further increased by using exterior shunts, provided that the a.c. range is always used at the frequency of calibration.

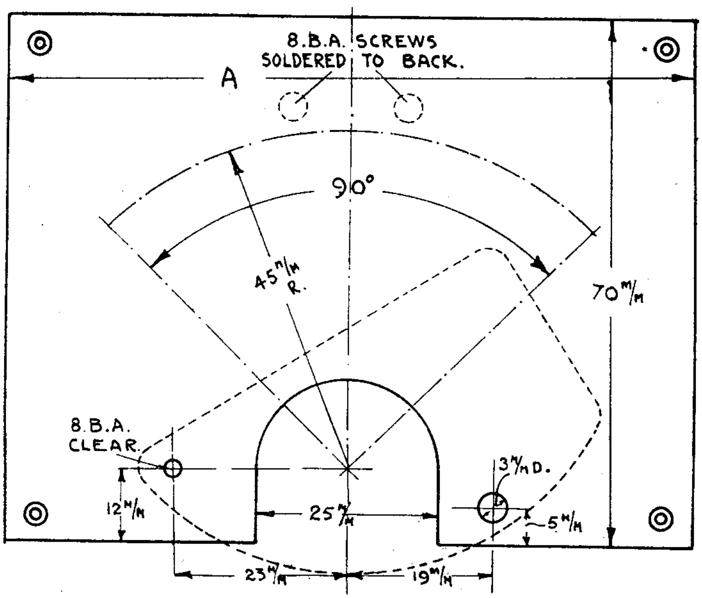
The first two instruments have movements obtained from the aforementioned " beam track indicator," and I thought a short description on the way these were modified might be of interest, considering the low price at which they can be obtained.

The first operation is to remove the metal shield on the back, which is secured by three countersunk screws and—in my case—by being a forced fit; I had to saw a slit up each side before I could remove it; but be certain when doing this that the saw-cut does not penetrate right through the bakelite case, because if dust gets into the movement the result is fatal.

Next, remove the cover by unscrewing three more similar screws (one of which is covered with wax), withdraw the cover, and the two

*Continued from page 440, " M.E.," October 6, 1949.

movements will be exposed. Carefully remove the dial plate by removing the two cheese-headed screws. Unsolder the leads from the terminal blocks, and by removing three further cheese-headed screws from each movement they can be released from the base. It will then be found that by swinging over the zero adjusting levers at the front and back of the movement the needle will swing to one side, so that a total movement can now be obtained of about 110 deg. of arc. It is important that the final movement should be arranged so that the pointers still move in their original direction, as they will then have a F.S.D. of about 160 mA, as against 200 mA if they were moved in the opposite direction.



TOP PLATE OF MOVEMENT SHOWN DOTTED

Fig. 2. Dial plate

Photo No. 4 shows the movements removed, and one fitted with a new dial.

The next job is to make two dial plates as shown in Fig. 2, one of which should be of the opposite hand. The dimension "A" will depend on the size of the case used to house the instrument, and this will depend on the sizes of the switches and other accessories used in the construction. Also, it would be well to check the dimensions shown to be sure that they suit your make of meter, because as far as I know a number of different manufacturers may have turned out this type of meter, and they may vary somewhat.

The plate can be cut from 20-s.w.g. hard brass sheet. One of the pillars supporting the original dial is left on each movement and this is used as one support for the new dial plate; the second fixing is an 8-B.A. cheese-headed screw which passes through a new distance-piece and an existing hole in the top plate of the movement, and is held by a nut and washer. To the back of the plate, in any convenient position, solder two 8-B.A. screws by their heads, to which is secured a small insulated tag strip to which should be joined the leads from the movement.

The next two operations are optional. The first is to polish and chromium plate the dial plate so that it may be used as a parallax mirror, and the second is to flatten out the last $\frac{3}{4}$ in. of the needle and twist it through 90 deg. so that it forms a "knife edge" pointer; this can be done by tapping it on alternate sides, using a small piece of polished steel as an anvil.

The scale of these instruments is not quite linear, no doubt due to the fact that the pole-faces do not extend right around the air gap, and so calibration cannot be carried out by using precision resistances and dead reckoning, but must be calibrated against another instrument. If such an instrument is not available, reasonably accurate results may be obtained on d.c. by purchasing a 16.5 grid bias battery, and calibrating from this, but the reader should ask to have each individual cell tested and the voltage noted, because although when straight from the factory, each cell should register 1.55 V, it is very unlikely that they will still do so when it reaches you.

If your meter resistance comes to an odd figure, it will make your calculation a lot easier if some wire is removed from the "swamp" resistance so that the final figure is exactly 1,000 ohms. Pointer stops can be made from 36-s.w.g. steel wire and fixed under the dial plate screw-heads.

The movement is fixed in the case by means of the dial plate, a wood-screw in each corner fixing it to small battens glued to the side of the case $\frac{1}{4}$ in. below the rebate that takes the panel.

The panel is made of transparent "perspex" the window area being covered with a gummed label, and the whole then sprayed with black cellulose, the label afterwards being removed. There is one drawback when using "perspex" for this job—by rubbing its surface, a strong static field is formed, which is sufficiently strong to pull the pointer a long way out from zero position, but I have not found this troublesome if care is taken not to polish the face just before use. A special anti-static varnish is made for "perspex," but so far I have been unable to find out either the maker or the formula.

I would again issue a warning about dust, these instruments are very sensitive and the slightest speck will cause erratic working, and

is very difficult to eliminate ; so treat the movement as you would the most delicate watch.

Before painting the back of the "perspex" panel it is as well to drill the necessary hole for the zero adjusting screw, because the exact position can then be seen through the panel, and marked accurately.

The original adjusters can be used, but it will be found necessary to break the case to remove

cardinal points will come as nearly as possible in line with those used on the d.c. range, allowance having been made in the windings to correct for the R.M.S. law. The specification of the transformer is as follows :—

Core, 35 No. 70-T. "Mumetal" stampings. Secondary winding, 2,200 turns No. 36 enamelled wire wound as neatly as possible—but not interleaved—on a paxolin former. Primary

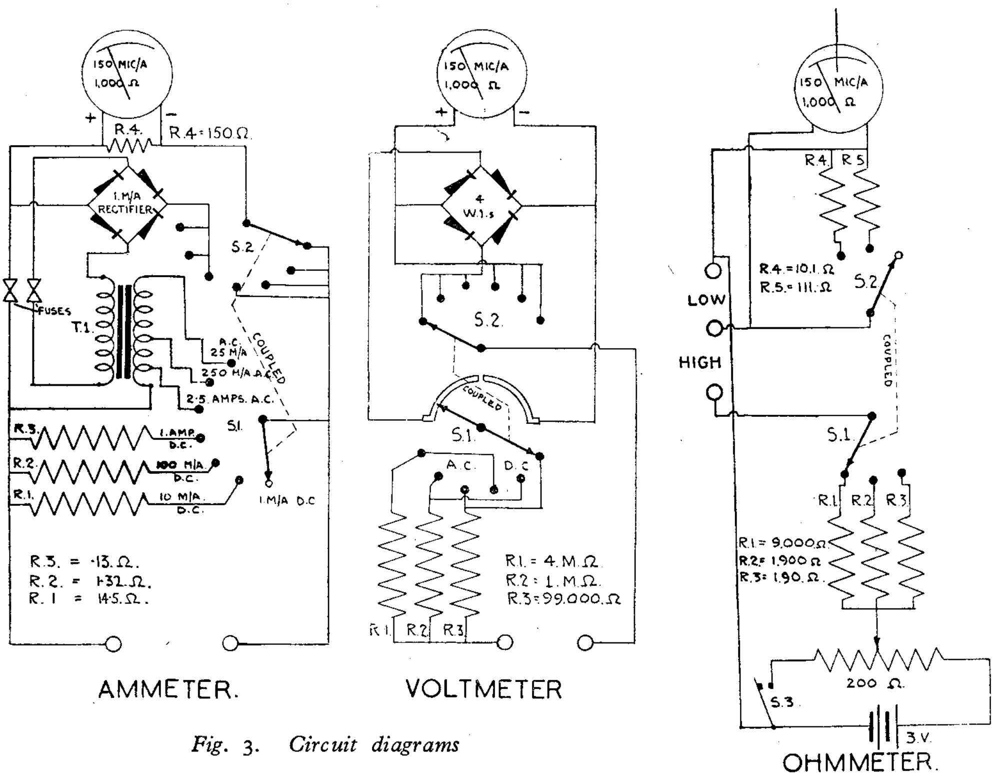


Fig. 3. Circuit diagrams

them. Both sides of the panel will have to be counterbored before fitting them owing to the increased thickness.

Suitable circuit diagrams for an ammeter, voltmeter, and ohmmeter, using these movements are shown in Fig. 3. In the ammeter circuit the movement has been shunted to make the F.S.D. 1 mA with a 150 (R.4) resistance making the total resistance $\frac{1}{1,000} + \frac{1}{150} = 130.5$ ohms.

The reason this has been done is because the a.c. transformer is much easier to construct, and if the higher sensitivity is desired on the d.c. side, this shunt can always be made detachable.

The rectifier in this case will be of the 1 mA bridge type, and a warning is given here that on no account must a load be applied to the rectifier without the instrument being connected thereto, otherwise the rectifier will be burnt out ; for the same reason, any fuses incorporated should be on the input side.

The transformer has been designed so that the

windings (2.5 A), one turn of No. 12 D.C.C. wire, the finishing end of which is joined to 9 turns of No. 18 enamelled wire to form the 250 mA winding, which in turn is joined to 90 turns of No. 28 enamelled wire to form the 25 mA winding.

A layer of Empire tape should be wound on between the secondary and primary windings.

The resistances used may be wound from resistance wire of appropriate gauge, except R.4 which alternatively may be ¼ W carbon resistance type. The switches are of the wafer type and are mounted on one shaft. Fuses have been shown, but are optional, and if used they should be of the lowest value obtainable, I haven't found out yet if a 60 mA fuse will safeguard either the movement or the rectifier.

The rectifier used in the voltmeter consists of four W.1 Westectors, bridge-connected as shown. The switch is again of the wafer type and if it is found difficult to obtain a wafer as S.1, two wafers may be used of the ordinary six

contact type, and the first three contacts on one used, and the second three on the other; the two wafers forming S.1 and the single wafer for S.2 are all mounted on one shaft. The resistances can be of the high stability ¼ W type, and the same ones are used for d.c. and a.c., should indicate the resistance if the scale is calibrated as shown in Fig. 5. If the resistance is below about 500 ohms, the "High" terminals should be shorted and the resistance placed between the "Low" terminals; the ohmmeter will now read down to about 20 ohms in the

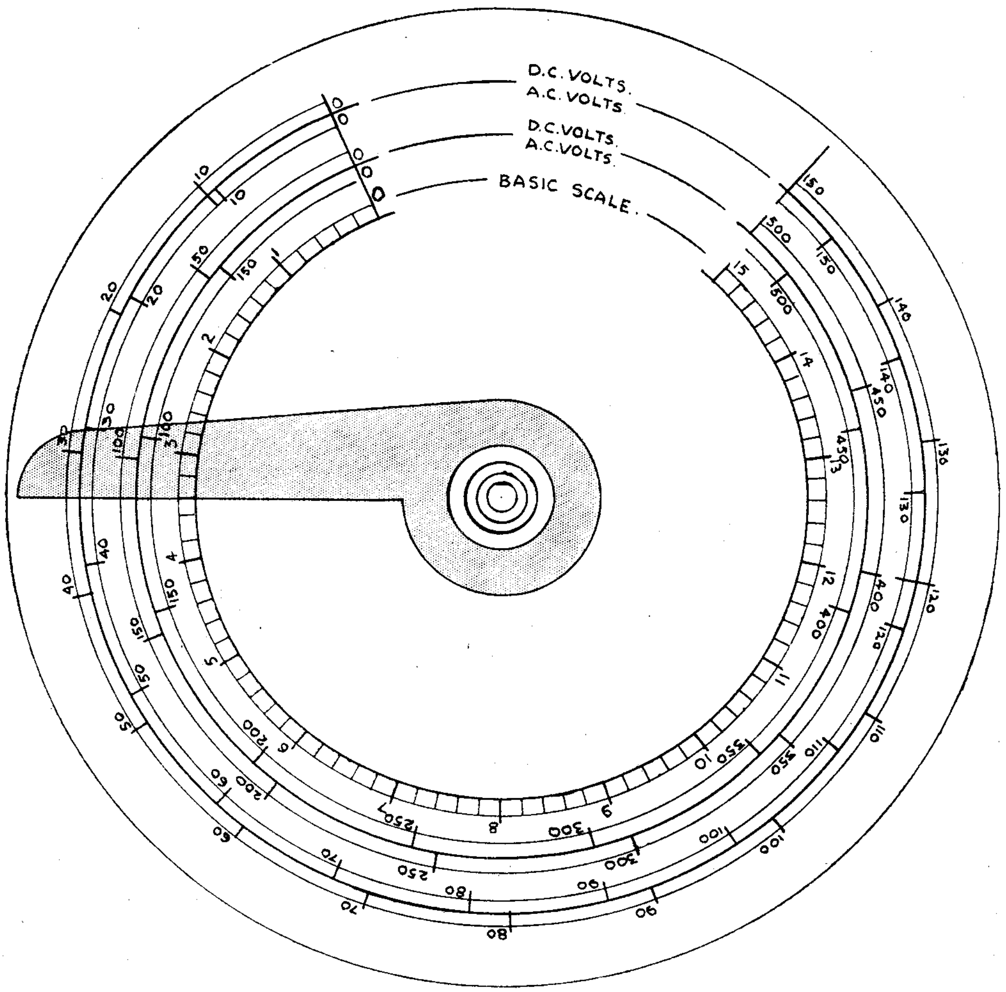


Fig. 4. Actual scale plotted against basic scale

two different scales being used on the dial; this overcomes the difficulty of obtaining odd value resistances.

The ohmmeter circuit operates as follows: The scale of the instrument should be of such a length that when the potentiometer is adjusted to give an output of 1.5 V—check with a second meter—and the switches S.1 and S.2 are in the position shown, the terminals marked "High" shorted, and S.3 pressed, full scale deflection is obtained. Then, with the shorting wire on the "High" terminals replaced by the unknown resistance, and S.3 again pressed, the pointer reverse direction, and by using the same terminals, but moving the switch to the other positions, resistances as low as 2 and .2 ohms may be measured. The switch S is incorporated to prevent the potentiometer draining the battery when the meter is not in use; this switch should be of the press-button type. If the meter is left for any length of time, before use, the "High" terminals should be shorted and the potentiometer adjusted to give F.S.D. when the switch is pressed; this will compensate for any voltage drop in the battery.

If any alterations are made to the switching

arrangement on the ammeter, care should be taken that when switching from one range to another, both shunts are not disconnected at the same time, allowing unshunted current to pass through the meter.

The ammeter range can be further extended by using exterior shunts, but on the a.c. range it can only be used at the frequency on which it was calibrated. A 1 milliamp a.c. range can be obtained by arranging that at one position of the switch the input is connected directly to the rectifier, but in this case allowance will have to be made for the R.M.S. error.

A very simple modification, that cuts out the work of drawing special scales for each range, and obtaining resistances of precision values, is to use a basic scale. To do this, draw a scale of a length that will accommodate the F.S.D., and divided into any convenient number of parts, let us say 15, and again subdivided as required. A circular scale is now drawn divided in the same way, but on a larger scale, and concentrically around this a number of blank scales. A cursor is now cut from a piece of "perspex" and pivoted at the centre of the circle as shown in Fig. 4. Connect up your meter in parallel with the check meter, and read the first point to be calibrated. If this is, say, 1 V on the 15 V scale, note the reading on the basic scale, set the cursor on the enlarged scale to this reading, and make a pencil mark against the edge of the cursor on one of the blank scales, marking it "1." Take another reading at 2 V and (*Continued on page* 476)

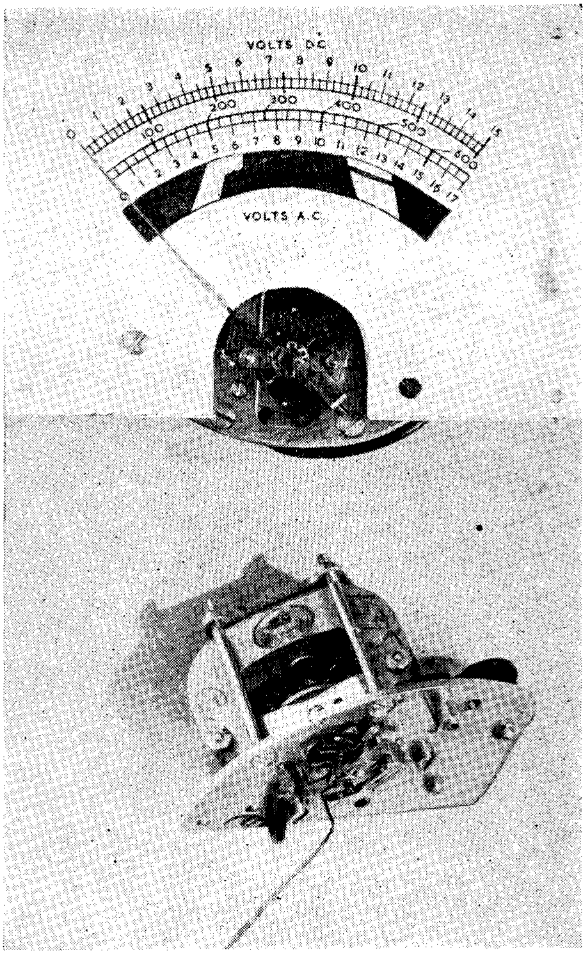


Photo No. 4. Movements removed from "Beam track indicator," one of which is fitted with a new dial plate, scale and mirror

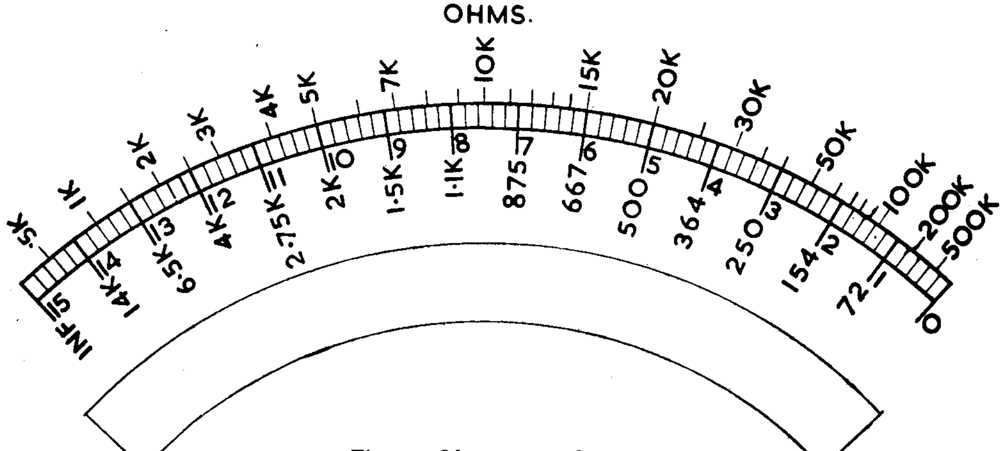


Fig. 5. Ohmmeter scale

A Pocket Size Workshop

by G. W.

LIKE many others in recent times, the writer found himself minus the prewar spare-room workshop, and, living in furnished rooms, the lathe had been disposed of and the larger hand tools in store together with a quantity of household goods. Something just had to be done about it, as, apart from any serious work, not even the smallest of odd jobs could be attempted. Frustration was hardly the word for it.

A small bench was obviously priority number one, but it would have to be kept in the dining room when not in actual use. The size of the bench was therefore limited by the odd square foot or two of floor space available and, of course, it had to be easily transported to the rear of the house for the evening or week-end session. Apart from practical considerations, the domestic authorities demanded that, when completed, the bench should look, as far as possible, as if it belonged to the dining room.

While this was being considered, the writer was offered a 2-in. lathe and treadle wheel for the proverbial song. The offer was accepted and it was decided to mount the lathe on a bench and so have almost a complete workshop in one unit.

A bench constructed of timber would have looked rather clumsy, due to the small overall size and the heavy sections required for solidarity, so angle-iron was used for the framework. A sketch of the frame, as illustrated in Fig. 1, was taken to the local ironmongers who, fortunately, were metal stockists, and also possessed a workshop, the equipment of which included a power hacksaw and electric welding plant.

They supplied and cut the angle-iron to length, welded up the frame all square, cleaned off the joints top and bottom, and made the treadle for a very reasonable sum.

The two straps through which the treadle-wheel spindle is bolted are of $2\frac{1}{2}$-in. by $\frac{1}{4}$-in. black mild-steel. These were welded on so that the wheel clears the floor by about an inch.

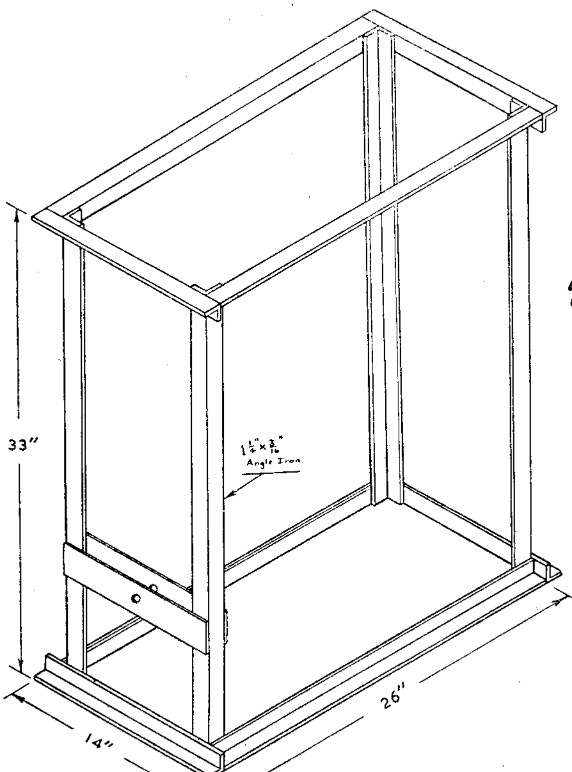


FIG. 1.—BENCH FRAMEWORK.

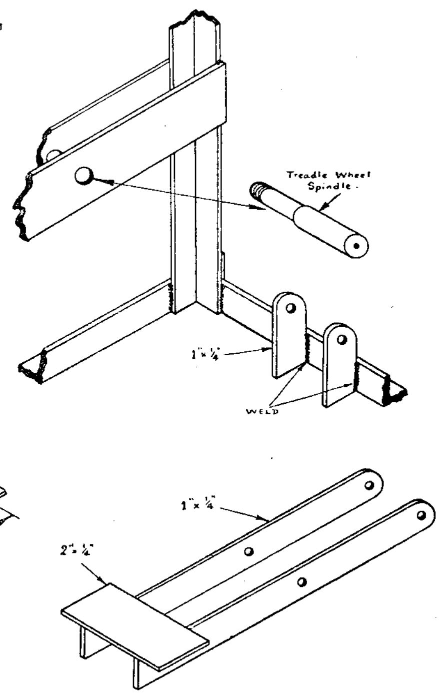


FIG. 2.—CONSTRUCTION OF FOOT MOTOR.

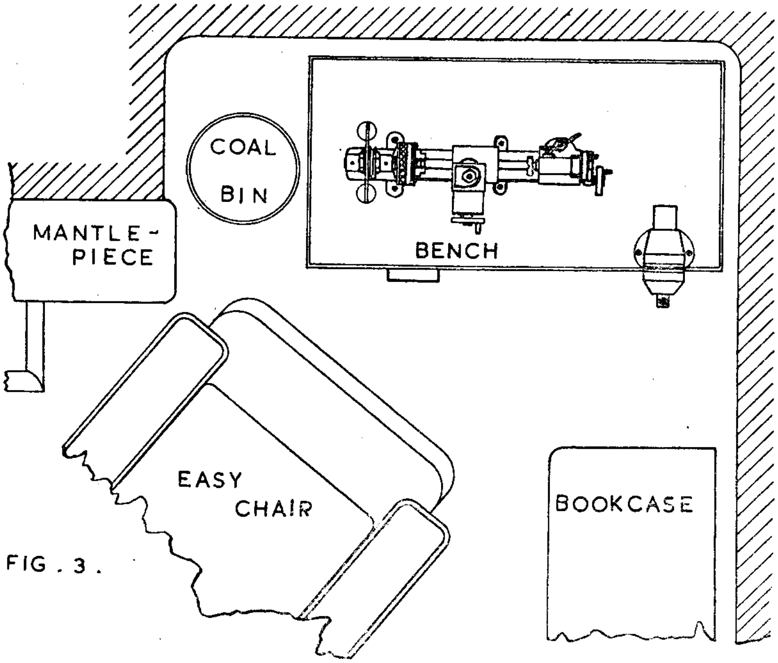


FIG. 3.

The bench top was made up of two pieces of $7\frac{1}{2}$-in. by $1\frac{1}{4}$-in. timber, 30 in. long. These were secured to the metal frame by $\frac{1}{4}$-in. coach bolts through the ends.

The top was then covered with good quality cork linoleum. Whilst this material is still very difficult to obtain for its legitimate purpose, many shops still have pre-war offcuts large enough for jobs of this kind.

The wood battens were screwed along the edges of the bench top and planed down to the level of the linoleum.

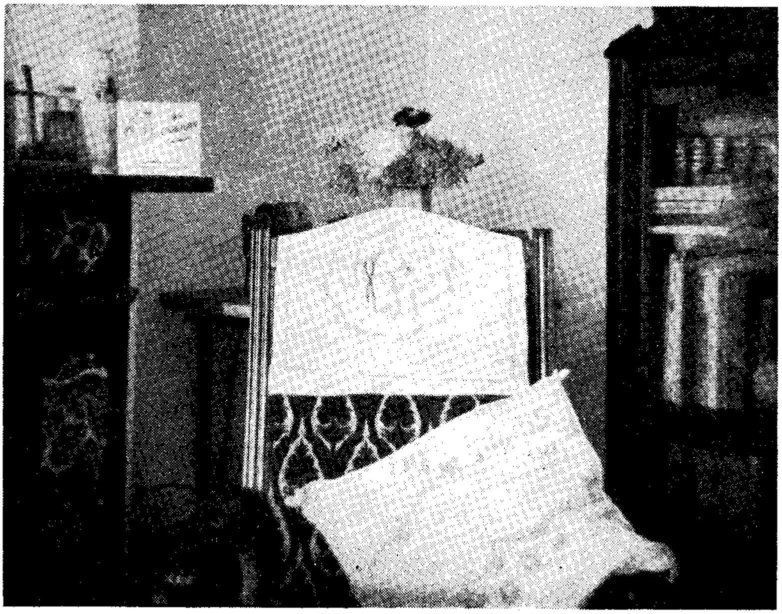
The complete frame, treadle, wheel and bench edges were painted to match as near as possible the dark oak furniture of the dining room and the linoleum was wax polished.

Fig. 3 shows how the complete unit fits into the corner of the dining room Far from being glaringly out of place, it is seldom even noticed. The back of the easy chair is a few inches higher than the bench and a vase of flowers usually stands on the bench in front of the lathe.

The unit has not proved difficult to carry to the rear of the house for use and many happy hours have been spent during summer months treadling away in the open air.

The box in which the hand tools had been stored proved to be very inconvenient. Much time was at first wasted in searching for any particular tool, and the casual piling of tools into the box wasn't too good for them, especially the files.

To overcome this, the combined portable toolbox and rack illustrated in Fig. 4 was made up and proved a blessing. Two large screws were Rawlplugged into the outside wall of the house against which the bench is placed and the box is suspended from these during operations so that everything is to hand.



The dining room workshop! Puzzle, find the lathe; see plan above

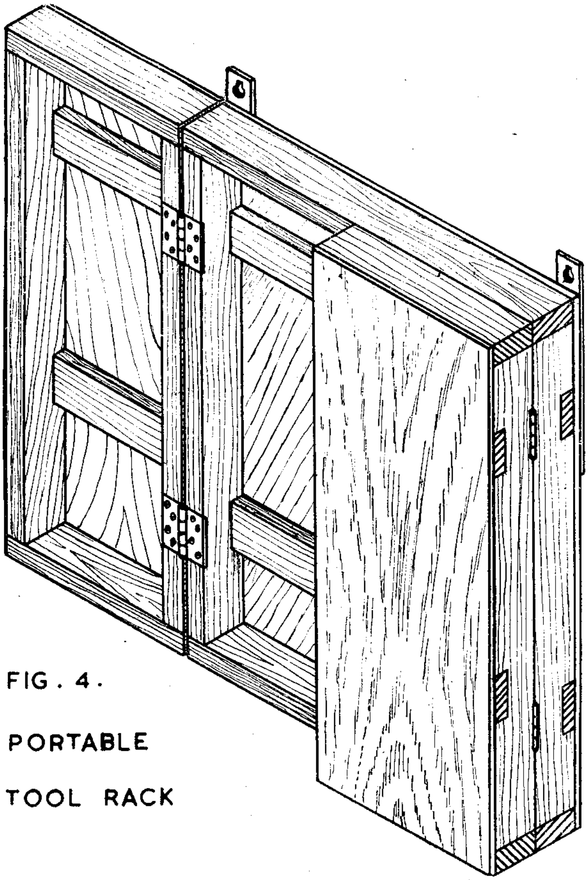


FIG. 4.

PORTABLE TOOL RACK

The main frames of the box are of 2-in. by 1-in. timber, toolracks of 2 in. by ½ in., and the plywood was salvaged from a tea-chest.

The racks in the central section are spaced to take large files at the top and small tools below. The racks in the doors are spaced to take the medium-sized tools. Spring clips were screwed to these racks to hold the tools.

The overall size of the box is 24 in. by 18 in. by 4½ in., and in off-duty periods it is stored underneath the bench.

Whilst it must be admitted that the above arrangements cannot be compared with a room specially set aside as a workshop, at least they have enabled the writer to do a fair amount of work, and have changed the situation from the impossible to only slightly inconvenient.

Voltmeters, Ammeters and Ohmmeters

(*Continued from page* 473)

continuing until the whole scale is filled. Each step can, of course, be in half or quarter volts for greater accuracy, or certain cardinal points can be marked and the intermediate divisions filled in at proportionate intervals. The cursor and scales can conveniently be fixed in the cover of the instrument case. Using this method of calibration makes the instrument less convenient to use, but in my own case I use both types of scale, the actual voltage scale is accurate to within 5 per cent., which is good enough in a lot of cases, and when I want a really accurate reading I use the cursor.

Important Note.—Since writing this article I have examined a beam track indicator of a different make, and find that instruments of this pattern cannot be converted as indicated, because one magnet serves both movements so that they cannot be separated.

To enable readers to recognise the correct pattern the following are some of the exterior differences.

Correct Pattern

Maker, Weston, but name not marked.

Dial has lines and letters painted on flat.

Terminals have horseshoe ebonite surround round each, projecting through metal shield.

Wrong Pattern

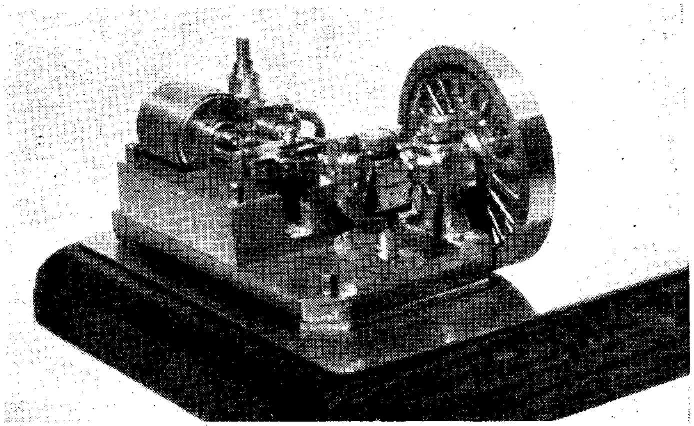
Dial has letters and lines sunk and painted.

Terminals have no surrounds.

My First Steam Engine

by

A. Howard Beere



AS a newcomer to model engineering, and very much a novice, the photographs of my first attempt—a horizontal steam engine, free-lance—may be of interest to other readers.

The cylinder is double-acting, $\frac{3}{8}$ in. bore by $\frac{1}{2}$ in. stroke, and with a kind of piston-valve. I say "kind of piston-valve," because not knowing just how piston-valves were designed, I made one how I imagined they were made, and to my delight, it worked.

Except for the flywheel, which was a model loco wheel casting supplied by Messrs. A. J. Reeves, of Birmingham, the complete model was fabricated from scrap, literally scrap, for the metal was mostly salved from an old water cistern that I had to have replaced in the house.

The engine runs very smoothly, and quite powerfully with air pressure (have not tried it under steam yet), and the shaft-driven feed-pump gives very healthy squirts when the suction pipe is connected to a water supply.

I realise, of course, that the model abounds with most of the model engineering errors that are possible ; some of which are now known to me, but hope to eliminate these at least in my next effort.

The Inspiration

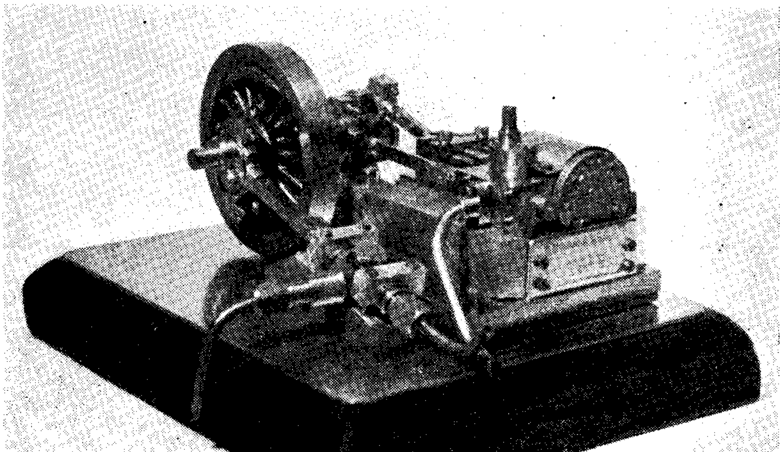
I had no drawing to work from, and indeed, the general layout was mostly governed by the rough shape and size of the various pieces of scrap metal to hand, but at the back of my mind the main idea was to try and make an engine just "something" after the style of that beautiful model by Mr. S. T. Harris, shown in the January 6th, 1949 issue of THE MODEL ENGINEER. This photograph I pinned up on my workshop door as a constant inspiration.

Workshop Facilities

My workshop is a kitchen dresser of the new 3-drawer, 3-cupboard type, and is very compact. It comfortably houses a "Rollo Elf" hand-driven lathe, a small-power drilling machine, a fair collection of model engineering impedimenta, and a top shelf "library."

I have had no actual training in the use of engineering tools, but have always been most keenly interested in all that kind of work, missing no opportunity of watching craftsmen at work.

I am hoping to develop some skill as time goes on, and eventually build something really worth while ; meanwhile, I find my new hobby intensely interesting and absorbing . . . largely filling the gap that leaving the Royal Navy after 30 years' service with all its interests, and starting in civil life, has left.



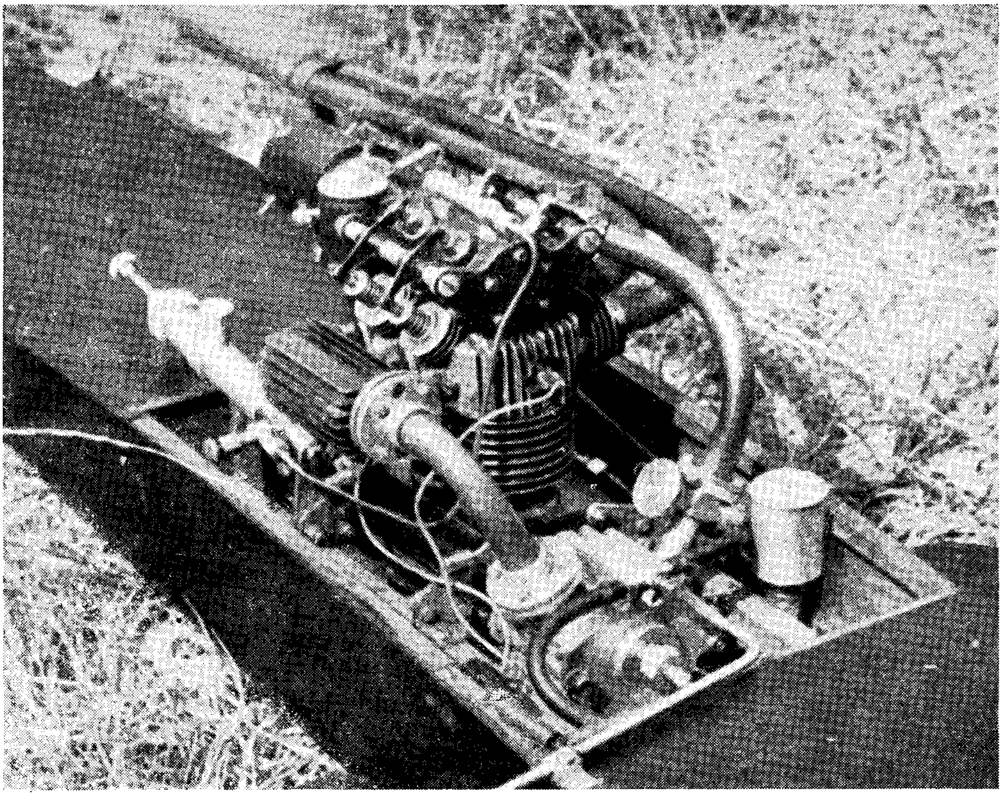
PETROL ENGINE TOPICS

Design for Progress

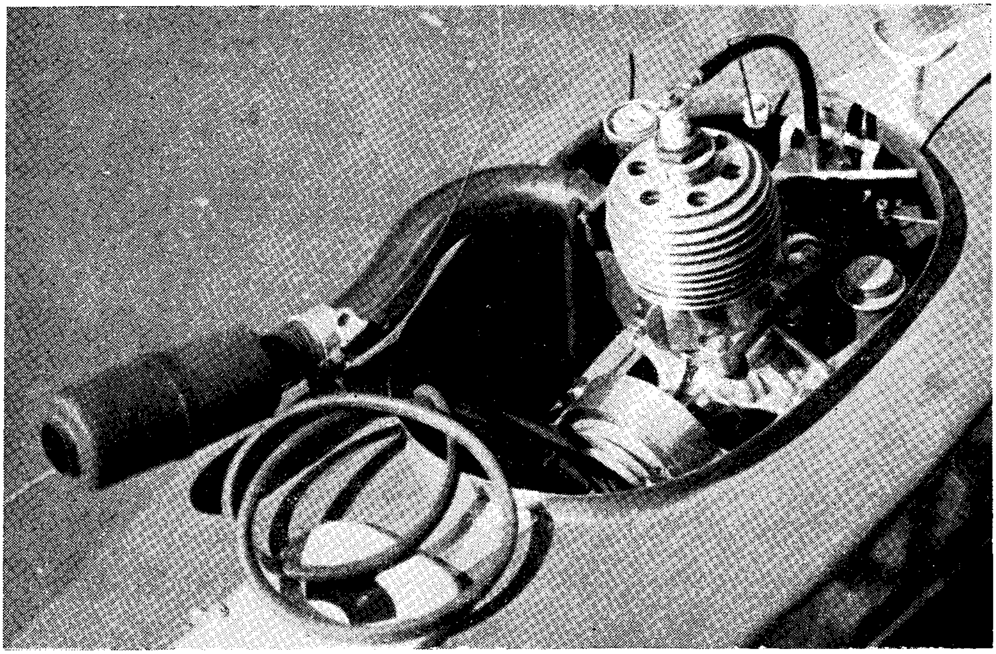
by Edgar T. Westbury

THE evolution of the small i.c. engine, from its very humble beginnings some half a century ago, has been marked by a consistent, though by no means evenly progressive, increase in efficiency, as expressed in terms of power output per unit of displacement capacity, and also in power/weight ratio. Early engines of this type were heavy, slow-running, and of low performance in proportion to their size, but the efforts of innumerable constructors and designers have gradually improved them in all these essential respects, eliminating faults and limitations which were once believed to be insuperable. In this respect the small capacity (dare I call it "model"?) i.c. engine has followed much the same lines of progress as the full-size engine; but within the last few years, its rise in performance has accelerated in tempo to a remarkable extent, and both in power output/capacity and power/weight ratio, it has now reached heights which would have seemed wildly incredible to the early pioneers.

To the serious student of engine design, the "logistics of causation" behind this increase of performance may not be easy to follow; it has not necessarily been directly due to improvement in design, as such, because many of the most successful engines exhibit no very pronounced differences in their design, and there are even examples of crude or even definitely bad features of design in engines which produce results. On the other hand, there have been engines of most painstaking design, in which the most up-to-date features of full-size practice have been incorporated, and every effort made to promote efficiency by logical methods, yet their actual performance has often been disappointing; so much so, indeed, that their designers have some-



The 30-c.c. twin overhead camshaft engine of Mr. B. Miles's "Barracuda II"



The 30-c.c. engine of Mr. H. Puntis's "Firefly III" is similar in mechanical design to the "Atom V" engine

times been caused to wonder whether the trouble they have taken to improve design is really worth while.

It is a fact that high performance in small engines is more often due to small detail improvements in construction, including high accuracy and finish, and the selection of suitable materials, and to the use of special fuels suited to high compression ratios, than to any improvement in the broader aspects of design. But, taking the long view, it is evident that all contributory factors in producing high performance must be kept fully in step with each other if true and consistent progress is to be achieved.

Many amateur designers of engines find it safest and most convenient to keep to conventional and well-trod paths of design ; maybe experience has taught them that it is risky to venture into uncharted territory, or perhaps it is simply that " the devil one knows " seems to be a somewhat less undesirable character than " the devil one doesn't know." There are many pitfalls for the unwary in exploring new or unfamiliar ground, and even at the best it is bound to be a slower and more arduous business than keeping to the broad highway.

It is a great pity that at the present time, the majority of i.c. engine enthusiasts are out for quick results, which certainly deters them from undertaking anything in the nature of basic research work. Many amateurs, to my knowledge, have the necessary intelligence and initiative to make important contributions to the progress of design, but are afraid of being left far behind in the frantic rush to obtain concrete results. The development of a new design, or even original details or components, may take quite a long time, as I know only too well, and the path of progress is strewn with the wreckage of partial or complete failures. Yet there is a great satisfaction to be obtained from design research in itself, quite apart from the actual results to be obtained from it, and the surest way of avoiding becoming bored with life is constantly to seek new worlds to conquer. There is no lack of problems to be tackled in the design of small i.c. engines—and the solution of even the least of them, though it may not win a race or break a record, will produce just as real a sense of achievement, unless one is interested in nothing beyond basking in the sunshine of a brief and shallow popularity.

Occasionally, the adventurous spirit who ventures to tackle major problems of design, and perseveres long and hard enough, achieves concrete success—but it is certainly not a pursuit to be recommended to anyone who cannot stand set-backs and disappointment. As I have so often pointed out in the past, every new development in design introduces entirely new problems of its own, every one of which must be overcome before the design can be successful as a whole. As every constructor knows, even engines of conventional design are subject to " teething troubles," but these are accentuated a hundredfold if any departures are made in major features of design. In recommending that more attention should be devoted to design by individual constructors, therefore, I may possibly be accused of glorifying difficulty for its own sake. Well, why not ? In our sports and pastimes, we deliberately introduce artificial hazards to make the game more difficult, and thereby bring out the skill of the player ; and no model engineer

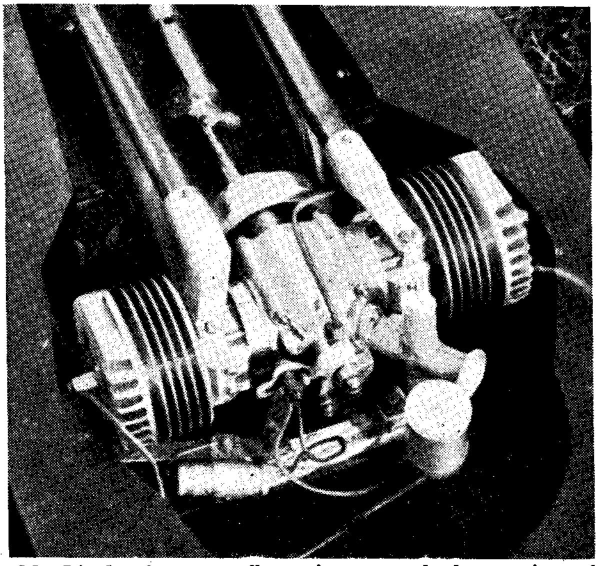
worthy of the name would wish to dally for ever with easy tasks or cheap achievements.

In the engine designs which I have described in the pages of THE MODEL ENGINEER, over a period of nearly a quarter of a century, I have sought to improve the standard of design and performance, and have carried out a considerable amount of basic research in order to smooth the path of constructors as much as possible. Many of these designs have been produced to suit the inexperienced constructor, more particularly in respect of facilities and equipment than skill and ability—I have a healthy respect for the excellent work which can be turned out by the determined novice, once he is shown how—but in every case there has been some definite contribution to design from either the technical or constructional aspect, or both. Even in the more advanced designs, however, my horizon has always been bounded by consideration of the ways and means available to constructors, and I have carefully refrained from putting before readers anything of a speculative nature, or involving major features of design which I have not at least tentatively explored beforehand.

I am often asked by readers why I do not publish "super" engine designs, for the benefit of readers who have aspirations to break world records with competitive types of powered models. My answer to this is that, assuming it were *possible* for me to produce such designs (I neither assert nor deny the possibility !) it would be most undesirable to do so from all practical points of view. The inexperienced constructor, in many cases, would find such a design beyond his capabilities ; he might build it of the wrong materials or to an insufficiently high standard of precision, failing thereby to realise its full performance—or, perhaps, even to get it to work at all, by no means an unlikely eventuality with an ambitious design of engine. The experienced constructor, on the other hand, would be almost certain to have very definite ideas of his own regarding design, and if he adopted the basic design at all, would probably introduce modifications and improvements. Any subsequent lack of success might then be laid to the blame of the design, and any achievements ascribed to the "improvements" !

I have always considered it most discreet to concentrate on *sound* engine designs which have in them the elements of high performance, and are capable of being exploited either by the novice or the expert, with normal equipment and facilities for construction. The rest is left to the individual, who, after all, must necessarily be in a position to make or mar the success of the design. By far the majority of constructors who have built engines to my designs have had at least a fair measure of practical success, and some of them have succeeded in obtaining a much higher efficiency from them than I have ever dared to claim. Many experts in the construction of racing engines have adopted the basic designs of my engines, adding their own details to produce still higher performance.

In making these claims, it is not my intention to usurp the credit of these successful constructors or to bask in the reflected glory of their achievements, but only to show that it is within the power of every constructor to develop the edifice of design, by starting on a sound basic foundation, and testing each brick before adding it finally and permanently to the structure. Advanced design does not consist of stringing together a number of features which seem to follow the latest practice, or which look good on paper. The designer should always satisfy himself that every feature has a fully understood purpose and is in harmony with the rest of the design. If one complicates the mechanical system of an engine, it is liable to lower the mechanical efficiency and one must be sure that the advantage it produces in the functional efficiency is sufficient to make this worth while. Increase in compression ratio also puts heavier load on the working parts—does it improve the mean effective pressure in the cylinder enough to ensure that the amount of useful effort available at the shaft is greater also ? In every detail of design, similar pros and cons arise, and must be sorted out and given their rightful place in the scheme of engine efficiency. It should always be remembered that the most serious problem in all small engines is how to transmit the power produced in the cylinder to the shaft, with the minimum frictional loss, and any engine design which ignores or fails to give sufficient importance to mechanical efficiency is bound to be a practical failure, however ingeniously it may be designed.

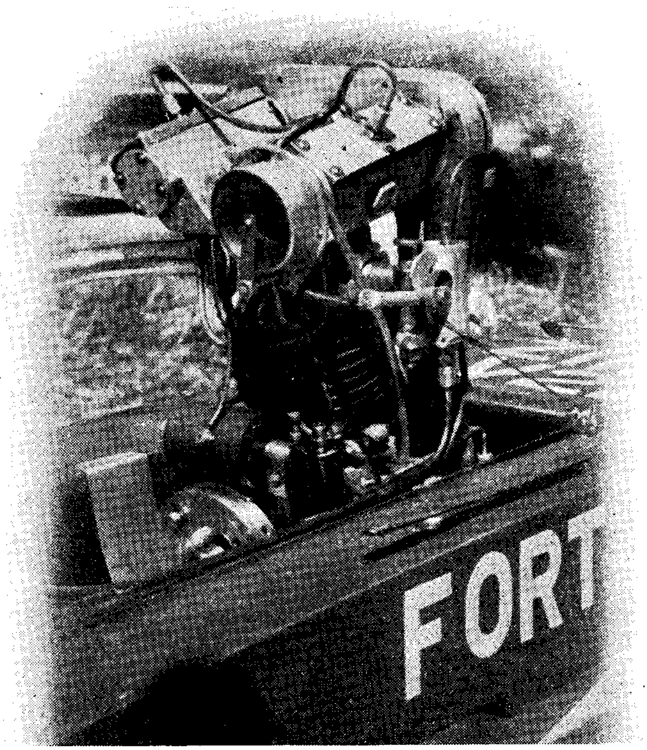


Mr. Lineham's 30-c.c. flat twin two-stroke bears points of similarity to the 10-c.c. "Craftsman Twin"

Examples of Enterprise

There are many pioneers who have broken away from the conventional paths of design in

small i.c. engines, and the results of their efforts, in some cases, have been illustrated and described in the "M.E." In only a few cases, however, have unconventional designs obtained any signal success in competitive events. One of the most ingenious and prolific of the individualists is our old friend Monsieur G. M. Suzor, whose engines have always bristled with original features, which have never failed to justify their existence by the results obtained. His early *Canard* engine was an eye-opener to all i.c. engine designers of its time, and the record-breaking *Nickie II* provided a further object lesson in engine design; but I think that his post-war 10 c.c. two-stroke, in the hydroplane *Mdlle. Sylla*, was not only one of the most unconventional and ingenious engines of its type ever made, but was also an outstanding example of a high-performance engine.



Some daring departures in design are seen in the 30-c.c. twin o.h. camshaft engine built by Mr. Fort, of the Victoria M.S.C.

The two-stroke engine, despite its comparatively simple mechanical design, has, generally speaking, been the subject of more adventurous research than the four-stroke, in which most of the advanced features have been adapted from full-size practice, mostly in the realm of motorcycle design. An exception to this rule, however, is found in the 30 c.c. twin overhead-camshaft supercharged engine by Mr. B. Miles, of the Malden S.M.E., which has lately enjoyed well-earned success in a very fast "A" class hydroplane. This engine, which was built during the war, made its first appearance at an exhibition of the Malden club, and later at the 1947 "M.E." Exhibition, where its excellent workmanship and good design were duly rewarded. Its success as a racing engine, however, was not obtained quickly or easily, and for a time it appeared very doubtful as to whether its potential efficiency would ever be realised in practice. One of the major problems was to obtain reliable ignition on the two cylinders at the very high compression ratio plus supercharge pressure; this problem was eventually solved by the use of glow plugs, apparently the only known example of their successful adoption on a four-stroke engine. During the present season the boat *Barracuda II*, to which this engine is fitted, has made many highly successful runs at speeds over 50 m.p.h.

I have followed the career of this engine with great interest, as I have known the constructor for many years, and am fully aware of the great pains he has taken to develop engine design. When he first made his appearance at the old South London club he exhibited an overhead-camshaft engine which gave evidence of his ability both as a designer and constructor. The practical application of this ability, however, proved to be an arduous task, and for years success eluded his grasp; I feel sure that a man of less moral stamina and determination would have given up the struggle long ago. At present he is running two other boats, both fitted with two-stroke engines, in "A" and "C" class respectively.

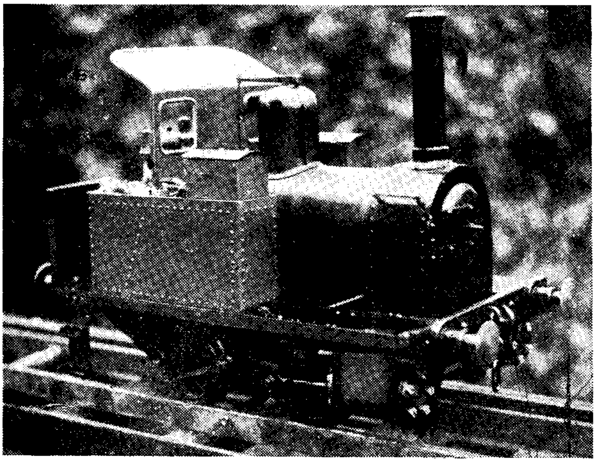
I have also had glimpses of the development of the overhead camshaft engine illustrated in this article, and although this is undergoing some vexatious teething troubles at present, there is reason to hope that the enterprise put into its design will eventually reap its due reward. The engine has twin overhead camshafts, driven by an enclosed roller chain. A flywheel magneto is provided for ignition. These examples represent but a few of the interesting experiments in design which are in progress at present. One might find quite a good deal to criticise in the engines which have been illustrated, but that is not the point; it is only by exploring all avenues of design, whether successful or otherwise, that progress is made, and if an idea is never given a fair trial, nobody ever knows whether it is good or not. All honour to those brave spirits who have not feared to venture against the unknown, or to defend a forlorn hope; no matter whether they triumph or fail, they have helped to speed the march of progress, and to inspire and encourage many others who are struggling with similar problems.

Running Ahead of Time!

by "L.B.S.C."

IT may be recalled that when first presenting the outline drawing of a small contractor's engine, made by Mr. Leslie Clarke, of Johannesburg, and suggesting that it would make an interesting job as a breakaway from the bigger engines, I gave a few "'ints and tipses," on which of my components to use in it, and also a drawing of a suitable boiler. This was before I adopted it as a fully-detailed "learner's job." Well, a Birmingham follower of these notes took me at my word, in a manner of speaking; put aside a four-cylinder 3½-in.-gauge "Pacific" he was building, and got to work on "Tich," with the result you see in the picture. Not only that, but our worthy friend, whose identity is Mr. J. K. Strickland, fitted piston-valves to her. He says she has surpassed all expectations, running away with a single passenger on a flat car, accelerating like a "Milly Amp" outfit, with a nearly negligible consumption of fuel and water. Our "L-card" friends, please note, take heed, and go and do likewise!

In a cheery letter in which he expressed appreciation of these notes, our friend says his first job was "Mollyette," the "O"-gauge engine which was intended primarily for a child's toy. This little engine climbed a stiff grade hauling a 7-lb. weight in a tin wagon. After that he spent 2½ years in building "Petrolea," a successful job in every way. Hearing somebody say that his engine would turn its wheels with 5-lb. pressure, when jacked up, Mr. Strickland went one better, by driving his engine around the Birmingham club track with only 5 lb. showing on the gauge, a half-dead fire, and a full glass of water; and by doing so, won a bet. He says that both he and Mr. Cokayne (whose "Petrolea" has been illustrated in these notes) have run out tests on the above track, each getting precisely the same results, running in mid-gear with only a crack of throttle; full regulator would be committing suicide.



"Tich No. 1," by Mr. J. K. Strickland

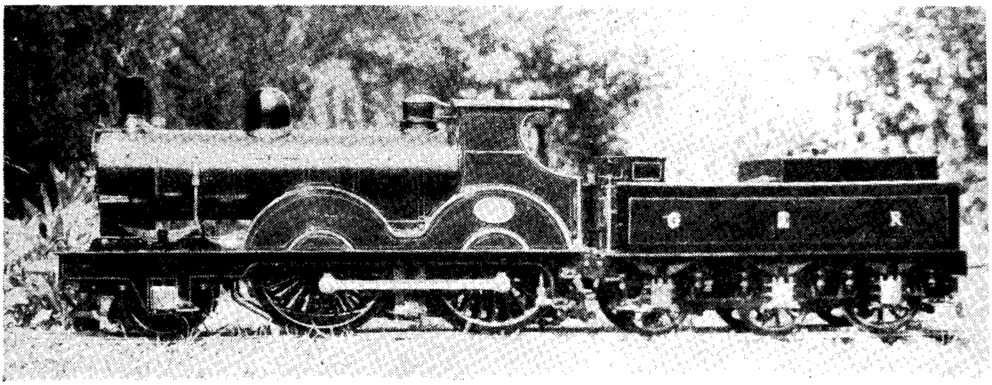
Mr. Strickland then built "Juliet," but with saddle-tank instead of side tanks; and this led to an interesting experiment, which proved once more, that the information given in these notes, is reliable. When the instructions for "Doris's" piston-valve cylinders appeared, the usual one or two members, well known in every club, who "know all the answers," started raising the usual moan. Mr. Strickland promptly changed over to piston-valve cylinders on the saddle-tank engine, using ½ in. diameter bobbins, and adding a snifting valve; the improvement was amazing, the blast nozzle having to be enlarged to 7/32 in. diameter, the hauling power increased, and fuel and water consumption lowered; a load was also taken off the valve-gear. The result of this experiment was, that when our friend built "Tich," he used piston-valve cylinders with $\frac{5}{16}$-in. bobbins, and she is "the cat's whiskers."

Congratulations to Mr. Strickland on his work to date, and best wishes for the successful completion of the four-cylinder "Pacific."

Beginners' Corner (*contd.*) Axles for "Tich"

The next job is a simple bit of plain turning; but for raw recruits, it involves a lesson in accuracy, as the ends of the axles must be a press fit in the wheel bosses. They must not be too tight, or the said bosses will split; whilst if the least bit slack, they will shift in the bosses under heavy turning strain, and jam up the whole works. Two pieces of ⅜-in. round mild-steel rod are needed, 4⅛ in. long. Chuck truly in three-jaw, with about 1 in. projecting. If the chuck is slightly out of truth, as most of the cheaper kind are, put a piece of foil, or even paper, between the offending jaw and the rod. To test, simply run up the slide-rest to the work, with a knife-tool in the holder, and pull the belt by hand. If the tool makes a faint scratch completely around the rod, it is set truly. If not, the side that isn't scratched, shows which way the adjustment must be made, to bring the rod O.K.

Use a knife-tool with the extreme sharp point taken off by a rub on an oilstone; this prevents the wheel seat being left scratchy. Face off the end of the rod, then set your slide-gauge or



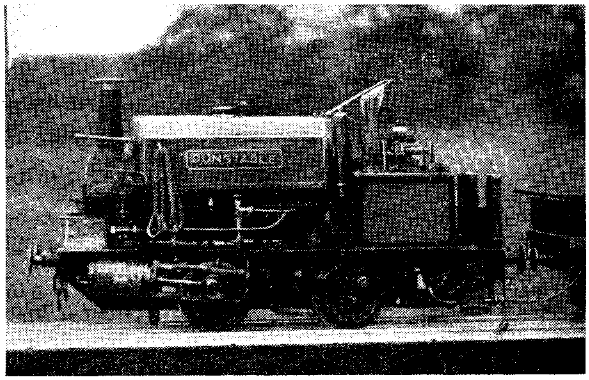
Mr. Strickland's " Petrolea "

calipers to 21/64 in., and turn down 13/32 in. length until the gauge or calipers just slips over. Next, if you have a $\frac{5}{16}$-in. taper reamer, enter it into the hole in the wheel boss, from the back, and take the merest scrape off the end of the hole, just a thousandth or so. If you haven't the reamer, you can take a scrape out of the end of the hole with a pocket-knife or scraper ; only the tiniest bit, to give the end of the axle a start. Now carefully turn down the end of the axle, until it will just enter the slightly enlarged end of the hole ; it should then be a press fit for the rest of the hole.

An alternative way is to turn the end of the axle until it just *won't* go into a boss which has not been slightly reamed or scraped. That sounds like Pat's way of giving instructions ; but when you come to do it, you'll get my meaning easily enough. Then with a smooth file, ease the turned part until you can push it in very tightly about halfway. The lathe should be run fast for this job ; and the wheel, of course, used for a gauge. The distance between shoulders, is 3 9/32 in.

If you haven't a three-jaw chuck, or one which is badly worn or very inaccurate, turn the axles between centres. For this job you need two pieces of round steel same length, but of little larger diameter, say $\frac{7}{16}$ in. or $\frac{1}{2}$-in. It doesn't matter about the chuck being wibbly-wobbly for making the centre holes ; just grip the bits of steel in it, and centre each end with a centre-drill in the tailstock chuck, same as for the wheels. Put the centre points in mandrel and tailstock, and mount one of the pieces of steel between them, with a carrier on the headstock end. Turn the other end to a press fit in the wheel boss, as described above ; then reverse the piece of rod between centres, putting the carrier on the reduced part. Turn down the other end to correct diameter, as above ; then turn the centre part to $\frac{3}{8}$ in. diameter. The axle will then be true with wheel seats. For the centre part, use a round-nose tool, and plenty of cutting-oil. When operating the lathe, don't stand in line with the revolving carrier, or you will get well and truly splashed, as the excess cutting-oil runs along the axle, and the carrier throws it off.

Press one wheel on each axle, same way as you pressed in the crankpins. Put a bit of soft sheet metal between the vice-jaws, wheel, and end of axle. If your vice is small, don't forget you can increase the capacity by taking out the steel insets of the jaws. If the vice-jaws won't open wide enough even then, a wheel press can be improvised by two pieces of bar, with a bolt at each end. The bottom bar is held in the bench vice, level with the tops of jaws, and the wheel is placed on it, with the axle held vertically over the hole in the boss. The top bar is then placed on top of the axle, with a piece of soft

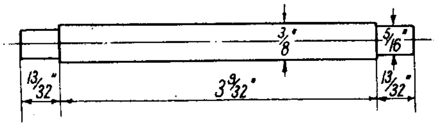


" Juliet " as a saddle-tank

metal between the bar and the end of the axle ; alternatively, a hole can be drilled halfway through the top bar, and the end of the axle placed in it. Then screw the nuts on the bolts until they just touch the bar, using finger pressure only ; put a spanner on each nut, *and screw down both nuts together*, turning the spanners exactly in unison. That will do the trick all right.

As a last resource, the axle could be driven into the wheel, using a lead or copper hammer, but I don't recommend it. It is more liable to

split the boss than a " squeeze " ; also there is a risk of slightly bending the axle. Incidentally, in the days of the " Rocket," when there were no hydraulic presses, wheels were driven on to axles by aid of sledge-hammers operated by



Axle

hefty specimens of manhood with muscles of the " village blacksmith " type—something you couldn't develop on 1949 meat rations ! Warning—whichever way you adopt, if the axle doesn't want to go into the wheel, don't force it too much, or the boss will split. Take it out again and ease it slightly. Castings are expensive, and time is valuable !

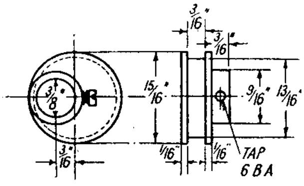
How to Turn the Pump Eccentric

Before pressing on the second wheel, the pump eccentric must be fitted to the driving axle. Builders who are intending to fit loose-eccentric valve-gear, will also have to fit the eccentrics and stop collars to the driving axle. I strongly recommend the loose-eccentric gear to all beginners who are hazy on valve-gear subjects, for two reasons. First, it is so simple to understand, and so easy to make and erect, that the veriest Billy Muggins is assured of economical and efficient working of his engine ; secondly, it is the *only* valve-gear that gives equal port openings at each end of the cylinder in both directions, plus absolutely correct timing. The wheelbase of the engine being so short, she will run on a continuous line in the limits of the average suburban back garden, so that there is no need for constant reversing. The valves may be set with a fixed early cut-off, combining easy starting with reasonable expansion, speed being controlled entirely by the regulator. The parts can be made much more robust than the Walschaerts gear without being clumsy and unsightly, so that the gear has a much longer working life, besides retaining accurate setting.

A piece of 1-in. round steel rod will be needed for the pump eccentric ; a stub end of mild steel shafting, is about the best material. Chuck it in the three-jaw, face off the end, and then turn about 5/8 in. length to 15/16 in. diameter, using a round-nose tool. Now with a parting tool, form a groove 1/16 in. deep and 3/16 in. wide, starting at 1/16 in. from the end. Anybody who has a lathe with plenty of " meat " in it, and a good solidly-built headstock, won't have the slightest difficulty in turning a perfect groove, but the majority of small lathes, even the much-advertised types, will probably chatter like nobody's business, leaving the metal at the bottom of the groove looking like the waves of the Danube. Well, don't worry. Just pull the belt very slowly by hand, feeding in with a very light cut, and slapping on a good dose of cutting-oil. This treatment will soon lop off the crests of the waves, and leave a smooth shiny surface. The parting tool should be about 3/32 in. wide, and you can take three overlapping cuts to obtain the full width. The wider the parting tool, the greater the tendency for it to chatter. When turning eccentrics on my Milnes lathe, there isn't a vestige of chatter ; the turnings come off in the form of a closely-coiled watch spring, with a sound just like bacon frying, though the smell of the cutting-oil isn't quite as appetising. The tool leaves a perfectly smooth surface ; I grind it with plenty of top rake. Incidentally, the front bearing of the mandrel is 2 1/4 in. diameter.

Having obtained a smooth groove, part off at 1/2 in. from the end. Now if you take a look at the faced end, you'll see that the tool has left a mark indicating the true centre ; scribe a line through this centre, cutting right across the end, and on this line, at 3/16 in. from the true centre, make a heavy centre-dot. This will be the " eccentric centre," as our Hibernian friend would remark. Chuck in four-jaw, and adjust until this centre-pop runs truly. Leave about 1/4 in. projecting from chuck jaws ; then open out the centre-pop with a centre-drill (size E for preference), drill a 1/8-in. or No. 30 pilot hole right through, open out again with 23/64-in. or letter T drill, and ream 3/8 in., to be a good fit on the axle. Beginners note, that drilling a pilot hole first, usually prevents the bigger drill making a hole larger than its diameter, especially when the drill has been ground by somebody who has had no previous experience.

Put a short piece of rod, any diameter over 3/8 in., in the three-jaw, and turn about 1/2 in. of it to a tight drive fit in the hole in the embryo eccentric ; squeeze this into the hole, same way as the crankpins were pressed into the wheels, entering it on the grooved side. Chuck the projecting rod in the three-jaw. When the lathe starts running, the eccentric will commence to " tumble " (many enginemen call eccentrics " tumbling blocks " or just " tumblers "). Face off the end ; then very carefully turn 3/16 in. length to 9/16 in. diameter, that is, flush with the



Pump eccentric

edge of the flange. Use a knife-tool, and be careful when feeding in, as the cut is intermittent, on account of the eccentric bobbing up and down. Drive the spindle out of the eccentric, and drill a No. 40 hole in the newly-turned boss, tapping it 1/8 in. or 5-B.A. The eccentric should now fit fairly tight on the axle.

How to Turn the Valve Eccentrics

If loose-eccentric gear is being used, the valve eccentrics are turned next, and they are easier than the pump eccentrics, as they have only one flange, and no bosses. Chuck a piece of 1-in. round steel rod in the three-jaw, and face the end as before ; but this time, turn down 3/16 in.

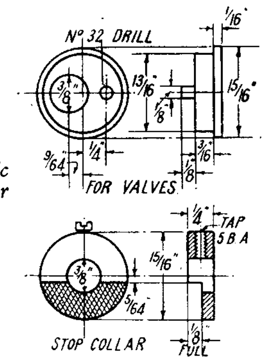
length to $\frac{13}{16}$ in. diameter with a knife-tool, and have the surface as smooth as possible. Turn down about $\frac{1}{2}$ in. length to $\frac{15}{16}$ in. diameter (size over eccentric flanges) then part off $\frac{1}{4}$ in. from the end; this will leave $\frac{1}{16}$-in. flange. Repeat operation for second eccentric, and then hold them in turn by the $\frac{13}{16}$-in. part whilst you take a finishing skim off the flange side. Some parting tools leave a rough surface; it all depends on the way they have been ground.

The true centre will be marked on the flanged side, as before; so scribe a line right across it. On one side of the centre, make a centre-pop 9/64 in. away, and on the other side, make another $\frac{1}{4}$ in. away. Chuck the eccentric in the four-jaw, holding by the $\frac{13}{16}$-in. part, and set the 9/64-in. pop-mark to run truly. Open out with a centre-drill, then with $\frac{1}{8}$ in. or No. 30, follow up with 23/64-in. or letter T drill, and finally put a $\frac{3}{8}$-in. parallel reamer through. Note that these eccentrics must be free on the axle, but without shake. Before taking the eccentrics out of the chuck, try one of the axles in the hole; if it does not push in easily, put the reamer through again, with a piece of wire in one of the flutes, just large enough in diameter, to make the reamer tight at the leading end. This dodge will cause the reamer to cut a hole that is slightly oversize, and the axle should then fit easily.

Drill a hole with a No. 32 drill, right through the eccentric, at the point $\frac{1}{4}$ in. from centre. This hole should be drilled either on a machine, or in the lathe, in the same manner as described for axleboxes. Put a short piece of $\frac{1}{8}$-in. round silver-steel in the three-jaw, and apply a file at the end, whilst the lathe is running fast, to reduce the diameter sufficiently to allow it to enter the No. 32 hole, then drive it into the eccentric on the side opposite the flange, cut it off $\frac{1}{8}$ in. from the surface, and smooth the end with a file. Serve the second eccentric in like manner.

Stop Collars

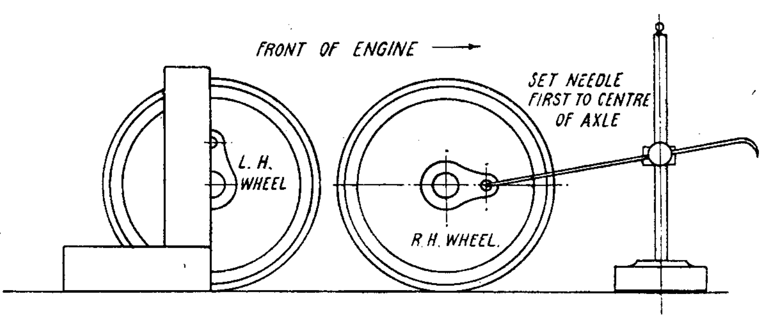
A stop collar is fixed to the axle next to each eccentric. This is a wide collar or boss, with part of one side cut away, leaving two shoulders, which catch against the stop pin in the eccentric, and drive it around, according to the direction in which the engine is desired to travel. Any beginner or raw tyro who does not understand the first principles of steam distribution—we were all in the same boat, at one time!—will readily grasp the whole sequence of events later on, when I describe the erection and setting of the valve-gear. Meantime, follow instructions carefully. The stop collars may be either brass or steel. Chuck a piece of 1-in. round rod in three-jaw, and turn down about $\frac{3}{4}$ in. length to $\frac{15}{16}$ in. diameter. Face off the end, centre, and drill down about $\frac{3}{4}$ in. depth, first with a $\frac{1}{8}$-in. drill, then with 23/64-in. or letter T drill. Part off two $\frac{1}{4}$-in. slices; but after parting off the



Valve-gear eccentric and stop collar (for inside motion)

first one, take a skim off the end of the rod, to make sure it is absolutely true, before parting off the second one. On the faced sides of these two collars, scribe a line exactly across the middle, and then another one 5/64 in. below it. Half of the collar then has to be cut away to this line.

The best way to do it, is to mill it, either on a regular machine if available, or else in the lathe, exactly as described in one method of milling axleboxes, viz. with the collar held in a machine-vice bolted to the lathe saddle, the cutter being mounted on an arbor or spindle between the lathe centres. The surplus metal could also be cut away in a planing or shaping machine, the collar being gripped in a machine-vice on the planer table, or on the cross-slide of the shaper. A straight-edged tool in the clapper box would soon remove the necessary metal, and leave the shoulders exactly on the marked line, to engage the stop pin in the eccentric.



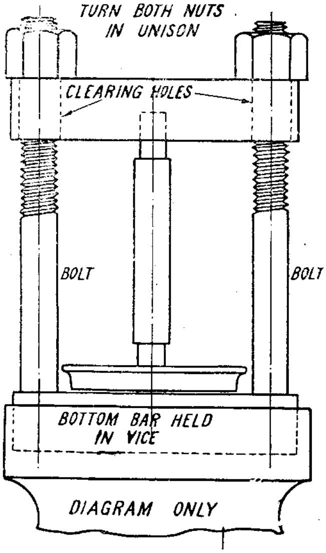
How to set wheel crankpins at right angles

The metal may also be removed by sawing and filing. First of all, saw straight across the collar, and halfway through it, just below the marked line; then carefully saw down the middle of the thickness, to meet the cross saw-cut, when the piece should fall out. Smooth out the saw

marks with a flat smooth file, and be careful to file exactly to the marked line, also to have the surfaces at right angles. In the thick part of the collar, drill a No. 40 hole from the edge to the hole in the centre, and tap it ⅛ in. or 5 B.A. The latter is preferable, as the finer-pitch threads give the screw a tighter grip without increasing the pressure on them.

How to Quarter the Wheels

This is a job that sometimes puzzles a beginner, but it is easily and simply done. First of all, put the wheels in place on the frame. Poke the driving axle through one of the rear axleboxes—doesn't matter which side of the frame—then



Improvised wheel-and-axle press

mount the blobs and gadgets on it in the following order. First, a valve eccentric, flanged side first. Second, a stop collar, with the cut-away next to the eccentric. Third, the pump eccentric, boss first or last, as you like. Fourth, a stop collar, plain side first. Fifth and last, the other eccentric, with the pin first, pointing to the cut-away in the stop collar. Then push the axle through the other axlebox, and put the wheel on as far as it will go by hand pressure, setting the cranks at right angles as near as you can "by eye." If you are going to use the outside valve-gear, there will only be the pump eccentric to go on the axle. Push the leading axle through the boxes, and put that wheel on likewise; don't forget that the short crankpin is the leader.

On this engine, the right-hand crank leads; that is, the left-hand crank is right at the highest point, when the right-hand one is in the forward horizontal position. I might here remind raw beginners that the right-hand side of the engine is to the driver's right-hand when he is standing on the foot-plate and looking towards the chimney. To set the cranks at the exact right angle, all you need is your try-square and scribing block (or surface gauge, to give it the posh title). Stand the engine on something flat, such as the lathe bed. Set the try-square with the stock on the flat surface, and adjust the wheels until the edge of the blade passes exactly over the centres of the axle and crankpin. Now set your scribing-block needle to the centre of the axle on the other side, and adjust the wheel on the axle, until the centre of the crankpin is exactly the same height, the needle pointing to the centre of the pin. The setting is O.K. when both these conditions obtain at the same time; have a good look at each side, without touching anything, to make certain it is so, and then the wheel can be squeezed right home. I have read much about making special jigs, fixtures and what-have-you, to get this quartering right; there is nothing against any of them, as they all do the job, but for my own part, I always use the method described above, and it never fails. Next items will be the coupling-rods, and the boiler feed pump, the pump being easier to erect, if fitted before the motion work.

Off the Beaten Track

A few days ago, time of writing, as it was a brilliant morning with every promise of a glorious day, your humble servant cast aside the daily grind of writing, drawing, correspondence and so forth; wheeled the faithful gasoline cart out of its "tin shed," and armed with a vacuum bottle charged with the enginemen's best friend, a packet of sandwiches, and a couple of petrol coupons, set off for "fresh fields and pastures new." It was a flashback to Curly's childhood days; but this time, four wheels took the place of two legs, thus giving the old rambling spirit a little more scope.

Croydon, Penge, Catford, Lewisham and Greenwich, were all negotiated safely in turn, and an involuntary blast on the "whistle" before entering Blackwall Tunnel, betrayed the old instinct. Then away through the dense traffic of East London—Canning Town, Stratford, Ilford—finally, passing through Romford and Gidea Park, we sighted the first "banner signal" in the clear position, 28 miles from home. Then we "notched up," settled down to the steady 50-52 miles per hour which is the most economical speed of the 2-2-0, and proceeded to emulate "Petrolea" of bygone days. We skirted Chelmsford, switched off left through the "Avenue of Remembrance" which forms the ring road or by-pass at Colchester, and headed for Ipswich, but just before reaching it, switched off once more to the left, on to the bit of Roman road leading to Norwich, 42 miles practically straight and level, with good surface. In due course the ancient city hove in sight; then we turned right, into the ring road, passed the old Great Eastern locomotive sheds, and took the road for Acle. Reaching that little town, we once more swung around to the north, and presently switched on to a by-road, at long last arriving at the little village of Repps. After a pause at the village pump, 1949 pattern, which supplies something more potent than water, and which at present needs coupons, we went down a side lane, pulled into a driveway, and were enthusiastically greeted

(*Continued on page* 489)

An Ornamental Whisky Cask

by "Scotia"

THE miniature whisky cask shown here was the result of my endeavour to create something new.

It provided, for me at least, a refreshing change from the more meticulous work of model making. Apart from one or two of the main dimensions, no great attention need be paid to sizes given, and these could be altered as occasion warrants. However, these drawings were used as a basis for size, as they appeared to have a well proportioned look.

The idea of turning a cask out of metal had been in my mind for some time, but I must confess it was some little time before I could think of the method of mounting it in a horizontal manner. Being desirous of obtaining the best possible quality and finish on the cask, I discarded the idea of making it from a casting, and accordingly set about getting a solid piece of brass for the purpose. This was gripped true in the four-jaw chuck, and well tightened—there is nothing to beat this type of chuck when it comes to holding a job firmly. First of all a parallel cut was taken on diameter to top diameter size of finished job. It was then bored up to depth, as per sketch, and opened out on the inside to the sizes given. Care had to be exercised here, as the widest part of the inside diameter is naturally its middle depth, and the wall thickness could be felt here between the fingers and thumb.

When the inside radius was finished, the opening was checked out to $1\frac{11}{16}$ in. diameter and this completed the work on the inside. There was no necessity to spend time on smoothing the inside radius, this entirely depends on the skill of the worker concerned. Indeed, anyone will find it wellnigh impossible to put a perfect finish on the inside.

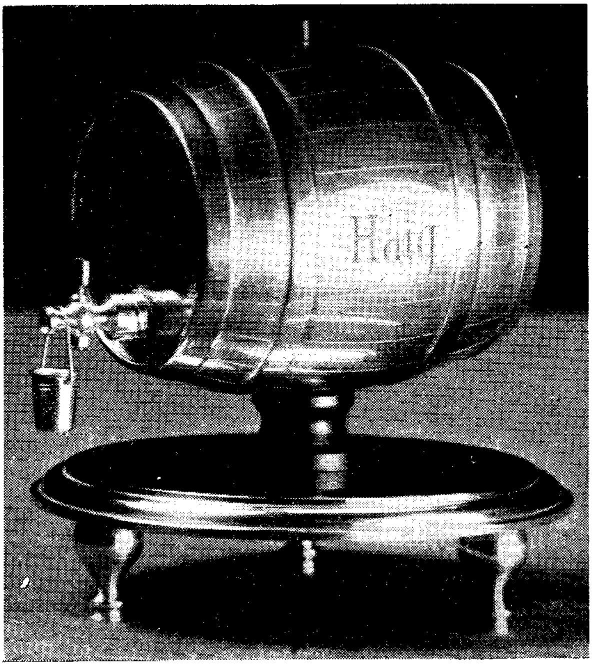


Photo by] [*W. Bell*

The unit complete

The outside diameter was next worked on, and long before I had turned it down to size, my ears were assailed with the screaming and "singing" which invariably comes when working on thin metal. However, after stuffing the cavity of the cask with rags as tightly as possible, this made a big difference, being in effect, a suppressor of noise, and also facilitating the fine finish desired.

Hand turning-tools were now brought into use; the diameter was reduced at various points in order to throw the "hoops" into relief, as these are an integral part of the job. The rags referred to had to be removed several times in order to feel with the fingers how the thickness was coming along. The average wall thickness throughout was around 3/32 in.

A very fine finish was carried out on the diameter, all unnecessary marks and lines being removed, and a brilliant polish brought about by using varying grades of worn carborundum, and finally a little rotten-stone with the lathe running at top speed. It was then parted off to the required length. The sketch will show that the recess necessary on the solid end is formed directly under the "hoop" at that end. An inside grip was taken and this recess carried out very carefully, taking very fine cuts as the grip was precarious.

The disc for the front was next made, being merely a piece $1\frac{11}{16}$ in. diameter and about 3/32 in. thick, the diameter being left a slightly tight fit for recess.

Using a makeshift dividing head marked in 24ths, the cask was next held by an inside grip, and this number of lines was put on lengthwise, their continuity broken only by the hoops, care being taken not to overrun the lines on to the hoops at any point. A surface gauge with a sharpened scriber was used for the purpose.

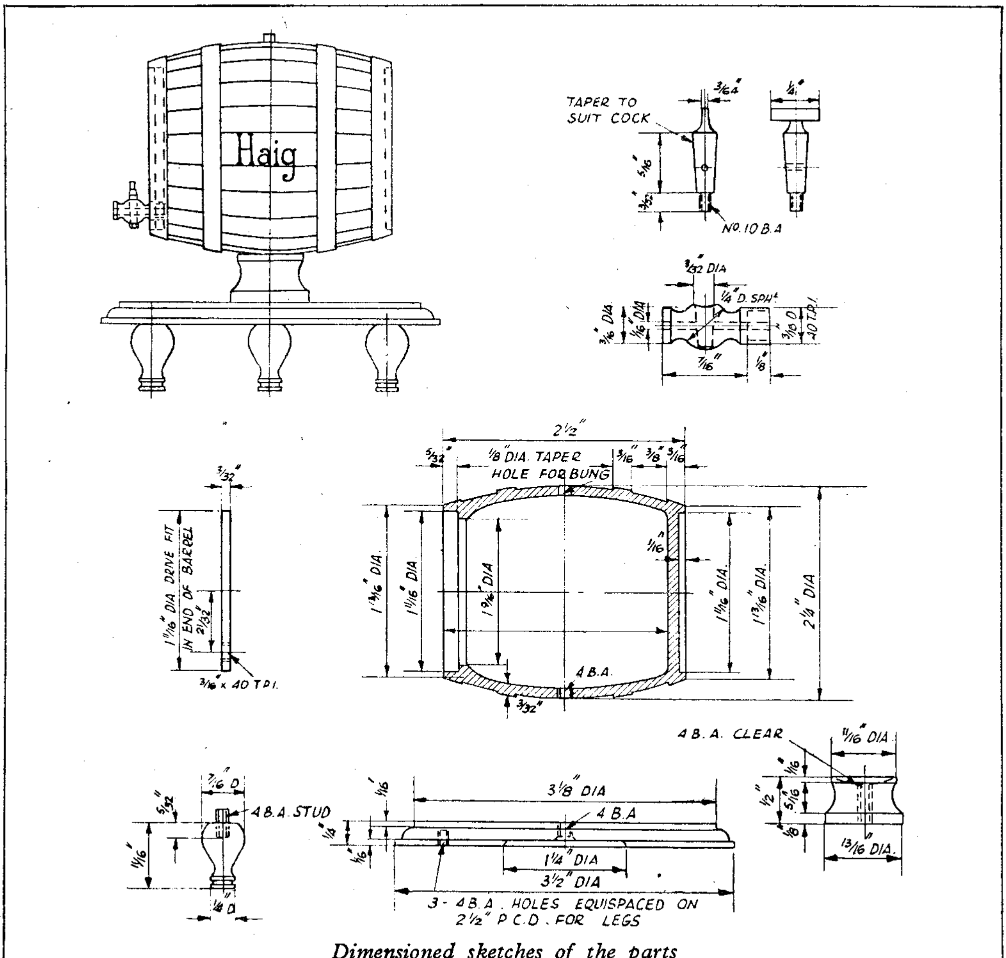
The lines thus made represented the staves and added considerably to the appearance of the job.

The end of the cask and the disc were also lined, the distance apart being approximately $\frac{1}{4}$ in. and each line height was measured off from a rule. The disc was then marked off, drilled and tapped $\frac{3}{16}$ in., 40 t.p.i. for the small draw-off cock.

The key was next drilled through the body at "open" position, taken out and rag-filed off, re-inserted and the nut lightly riveted over.

Although a dummy cock can serve the purpose, I made one in the correct manner.

The cask was next marked off and drilled for the bung, a small tapered hole being situated centrally between the lines. A hole was also



Dimensioned sketches of the parts

The cock was made from a scrap of chilled phosphor-bronze, the body being turned up to sizes shown on sketch. The position for key was found by screwing the body on to disc and lightly marking with a centre punch. This was drilled through $\frac{1}{16}$ in. and opened out with a small tapered reamer.

The taper on the cock key was found with little trouble, and with a spot of sand and water was ground to the body. It was completed by screwing the end of key 10-B.A. and putting on a nut.

drilled and tapped 4-B.A. directly underneath for the support bolt.

I was fortunate in having a solid brass plate about $3\frac{1}{2}$ in. diameter for the table top, and this was gripped in a self-centring chuck fitted with internal jaws. It was turned to the dimensions shown, and afterwards reversed in the chuck, and the underside faced off. It was checked on the underside a little to relieve weight, and a hole drilled and tapped centrally 4-B.A. Before removing from the chuck, a light centre-punch mark was given at three points slightly in from

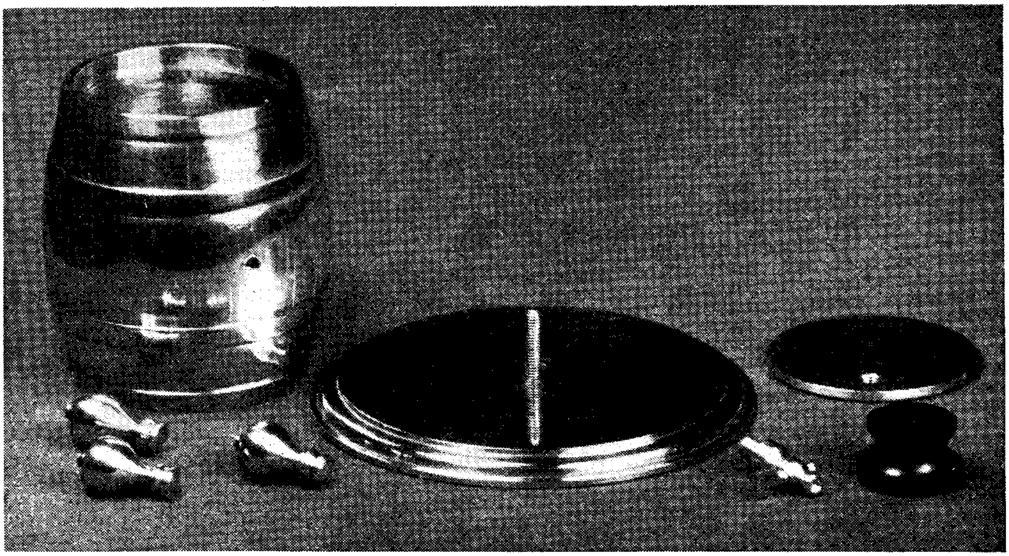


Photo by] [*W. Bell*

Showing the parts before assembly

edge, using the chuck jaws as a guide. The three punch-marks were drilled in for a short distance and tapped 4-B.A.

Some odd pieces of $\frac{1}{2}$-in. round rod provided the means of making the feet, a short length of 4-B.A. stud being inserted tightly before parting off. After smoothing away any roughness due to cutting, they were screwed into the table top.

The distance-piece between the table and cask was turned from a piece of black tufnol rod—the tiny bung also being made from this material.

As all the parts were then complete, the disc was driven into position, a short screw run through the table top, the distance-piece slipped over it, and the barrel lightly screwed on.

As a final touch I had " HAIG " engraved on the side, and I am indebted to this well-known firm for permission kindly given for their name appearing in the photograph.

The finished job looks well, and rouses comment and admiration from friends, especially the menfolk.

" L.B.S.C."

(*Continued from page* 486)

by the Morse family, whom we had not seen since they left Sussex some $2\frac{1}{2}$ years ago.

The Morses still go in for " big little 'uns ! " The new home is built chalet-fashion, being a sort of elevated bungalow, in a manner of speaking, the workshop being underneath it, and extending the full length. I wish I had the same floor space! Father Rob himself, has just completed the chassis of a 15-in. gauge American switching locomotive, and has been invited to try it out on the Romney, Hythe and Dymchurch line when it is complete. Denis has bought a full-sized steam tractor, which he uses for shunting in the carriage sidings, the " carriages " being caravans which are hired out to holiday-makers. He has also bought two old cars, an ancient Standard and an old Model T Ford (" Tin Lizzie "), which he has put into going order, and drives for amusement. Readers of this journal may recall the lovely " scale " windmills built by Bob, the youngest son; well, Bob has let himself go now, for he has purchased a full-size windmill, and is busy restoring it to working order. Eldest son Ray, who loves ancient history, has built an electrically-driven scenic gadget showing a short section of the Nile, with a period barge, complete with Pharoah taking it easy, whilst the black slaves emulate Cambridge en route Putney to Mortlake, but not at the same speed! The boat rocks, the scenery moves, and coloured lights give the impression of morning, noon and night. I told Ray he should describe it for this journal, as something out of the common.

The afternoon flew by, all too quickly; a chinwag, a cup of the engineman's best friend, and the time came to say farewell. Setting the head of the old gasoline cart to the south, we glided off, as the family waved us a goodbye and God-speed. The evening shadows lengthened, dusk fell over the countryside, and then came darkness; on and on we went, with hardly a check, until at long last the lights of London came into view. Still onwards, through the big city, out through the southern suburbs, into Surrey, and finally home, tired but happy, after a round trip of just under 300 miles.

*Traction Engines not so Well Known

by Ronald H. Clark, A.M.I.Mech.E.

AN outline arrangement of *The Wonder*, another large compound traction centre engine supplied to the late Mr. P. Collins, of Walsall, is shown in Fig. 44, and the arrangement of the merry-go-round drive is seen in the end view, which should be studied in conjunction with Fig. 43 in the September 29th issue. The cylinders are the same size as in the preceding engine and both had the slide-valves on the outside for accessibility.

A simplified example was also made in the form of a single-cylinder engine, and one called *Enterprise* is illustrated in Fig. 45 which shows very clearly the centre roundabout drive, or spinning top, erected in position. No smoke-box or dynamo bracket is included, and the organ engine is mounted on the offside centre supporting plate. The engine is basically a production 8-n.h.p. single-cylinder machine.

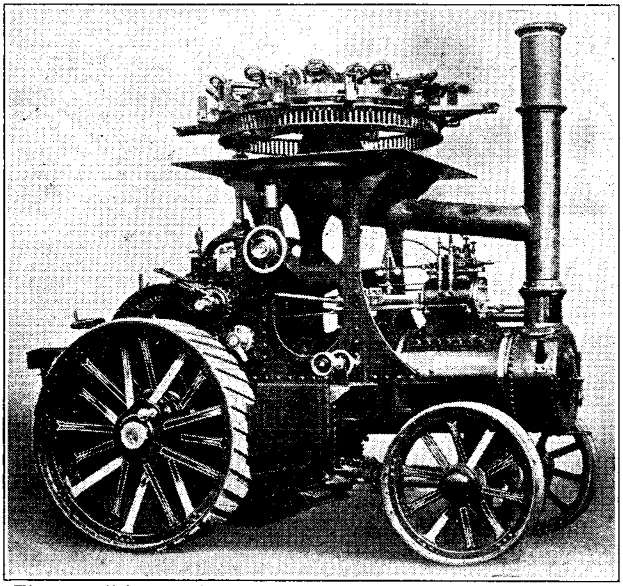


Fig. 45. "Enterprise"—a single-cylinder Savage traction centre engine

The top cradle- or lantern-wheels form interesting examples of mill gearing having usually 108 pins 1 in. diameter at $2\frac{1}{8}$ in. pitch on a 6 ft. 1 in. p.c. diameter. Road gear ratios were 12.18 and 24.28 to 1 for the high and low gear respectively, and the total reduction in the drive to the turret, or spinning top, was 26.64 to 1.

Before the advent of the traction centre engine, the roundabouts or merry-go-rounds were driven by a duplex centre engine erected on a locomotive-type boiler, the whole being mounted on four road wheels which formed a very heavy truck in the road train of vehicles, especially when it was horse-drawn. But when the centre engine was combined with the traction engine, as we have just seen, this heavy "dead" item in the train was eliminated. The traction centre engine was later itself eliminated when the road locomotive proved itself capable of dealing with any and all loads the showman might require to have moved. Even so, some traction centre engines were still at work at Hull Fair until during the first war. There might be one left derelict yet in some forgotten yard.

Needless to say, all these showmen's engines were most excellently painted, polished, lavishly decorated and equipped and the workmanship was of the very best throughout.

Like many of the larger traction engine builders, Savages designed and produced a light type under 5 tons unladen steam motor tractor to comply with the Motor Car Act, 1905, and they gave it the name of *Little Samson*, and a view of one is seen in Fig. 46. Rated at 4 n.p.h. it had a single cylinder, 6 in. × 9 in., and was spring-mounted, the rear axle being carried in axleboxes which could rise and fall in the hornplates and which were damped above by a coil spring of rectangular cross-section. A semi-elliptic spring was fitted to the front axle.

The boiler was 1 ft. $11\frac{1}{2}$ in. inside diameter × 4 ft. $4\frac{1}{2}$ in. long between tubeplates, and had 29 tubes of 2 in. outside diameter. Two speeds were fitted, the crankshaft pinions having 17 and 28 teeth, second motion gears 68 and 57 teeth, the final drive having 15 teeth in the second motion shaft pinion, the gear on the rear axle having 62 teeth. This gave ratios of 8.41 to 1 for the high and 16.53 to 1 for the low gear. The differential was of the two-bevel type.

The main dimensions, other than those given above, are:

Overall length 13 ft. 8 in. Overall width 5 ft. 9 in. Flywheel 3 ft. diameter × 4 in. face. Rear wheels 4 ft. 6 in. diameter × 10 in. wide. Front wheels 3 ft. diameter × 6 in. wide. Wheelbase 7 ft. 1 in. Height to top of chimney 9 ft.

Other interesting features are the rear wheels

*Continued from page 419, "M.E.," September 29, 1949.

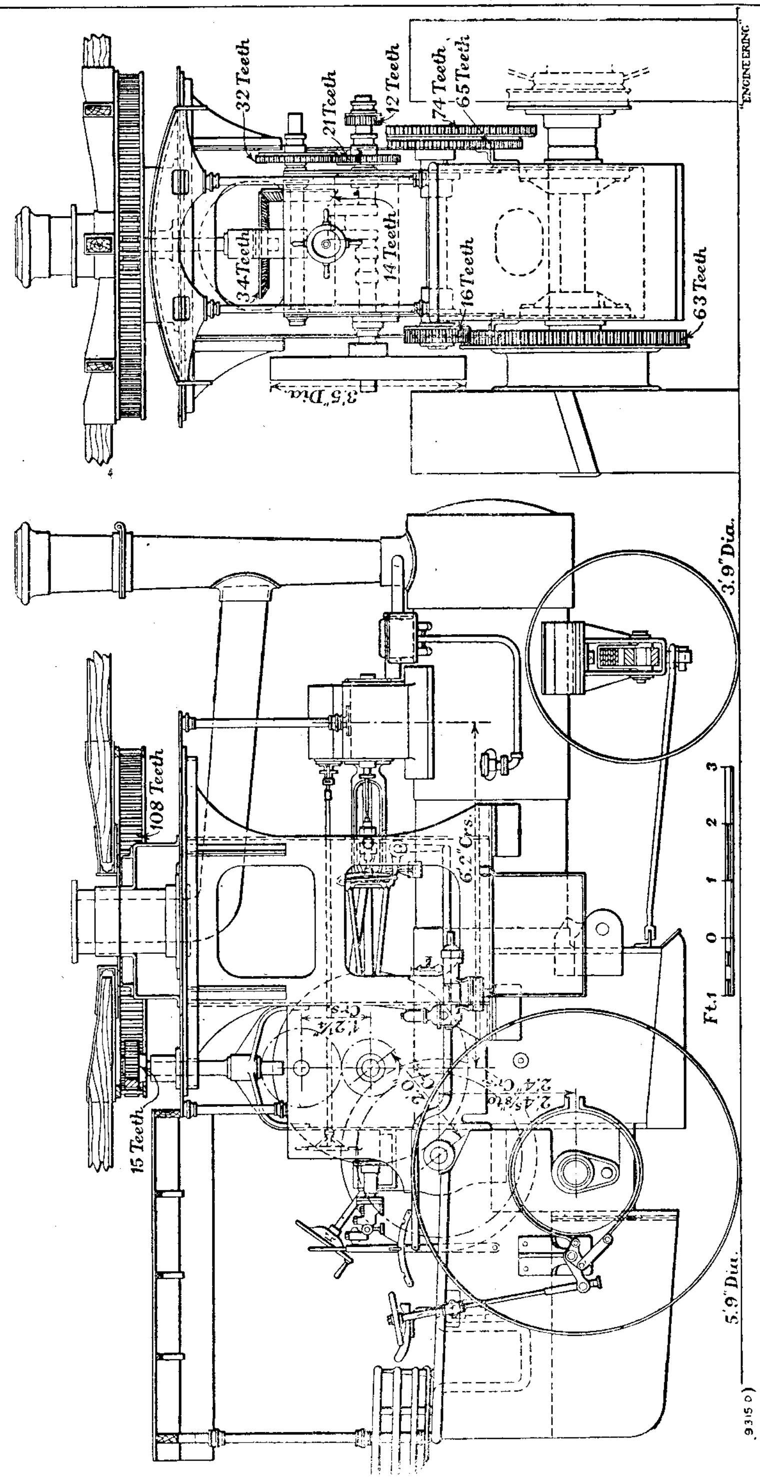


Fig. 44. Outline arrangement drawing of "The Wonder," another showman's engine by Savage, of Lynn

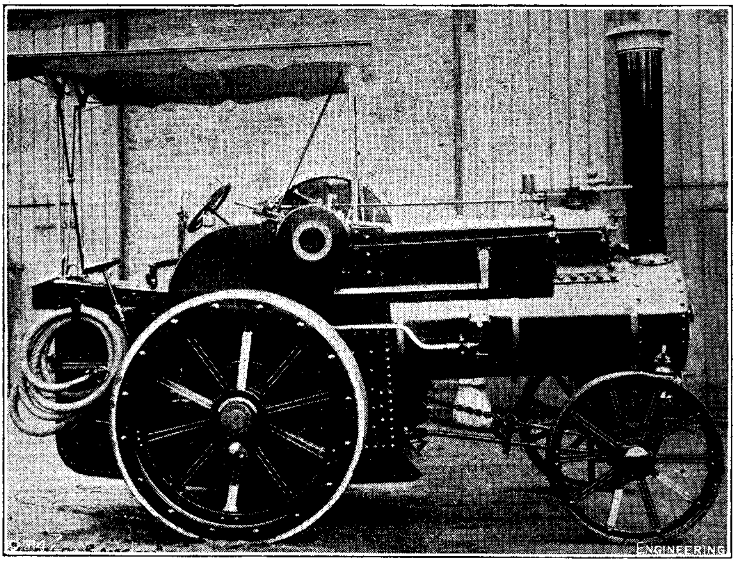


Fig. 46. *Savage's "Little Samson" tractor*

The *Little Samson* was also made with full showman's equipment, the last to be made being turned out in this manner was supplied to H. Studt Esq., in 1910.

A special 4-5-n.h.p. *Little Samson* tractor having a cylinder 6½ in. × 9 in. was made later in 1910 and exported to Norway.

Visitors to the works at Lynn, and to the founder's birthplace cottage at Hevingham, Norfolk, should note particularly the railings around the offices of the former and the gate to the garden of the latter. Both are of the same simple construction with diagonal ties in the panels, the junction of the diagonal ties being a cast-iron plaque bearing in relief a representation

which are shod with hardwood blocks set endwise to the grain, a cylindrical exhaust feedwater heater below the cylinder block on the near-side, and a screw-down externally contracting brake having the drum on the offside of the rear axle close to the wheel.

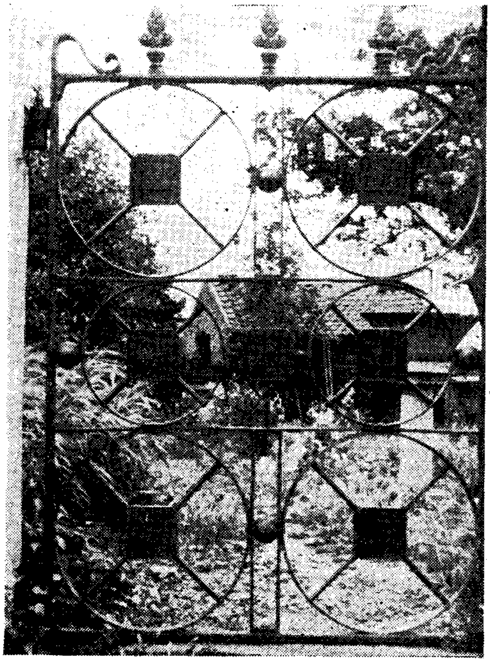


Fig. 47. *Garden gate to F. Savage's birthplace*

of Frederick Savage standing in his No. 1 traction, of which I show a view in Fig. 47, this being the only example known to me of a traction engines used in a design for domestic purposes.

Comparisons are not always odious and the reader can reflect, no doubt in a satisfying manner, upon the progress made between Frederick Savage's No. 1 and the handsome engine in Fig. 48—the last to be made at St. Nicholas Works, and numbered 864.

XXI—Wm. Sparrow Ltd., Martock, Somerset

A small country shop founded by one of the Parsons family, Wm. Sparrow their foreman eventually acquiring the business.

They made a small number of traction engines and a few are still at work in the West Country. They are of a straightforward design using the three-shaft principle and are very similar to those produced by the well-known firm of Wallis & Steevens Ltd., of Basingstoke.

XXII—William Tuxford & Sons, Skirbeck Ironworks, Boston

First established by William Wedd Tuxford, in 1826, who very soon achieved a reputation as a fine iron founder and manufacturer of agricultural machinery. He made his first portable engine with an oscillating cylinder in 1842, and in 1871 his last engine, which was a curious but interesting road locomotive having plate frames as in railway locomotive practice, the driving axle and wheels being placed in front and just aft of the smokebox. A countershaft was mounted just behind the main axle which it drove by gears, and the drive from the crankshaft on the firebox to this countershaft was by pitch chain.

By 1876 and onwards, the uncommon-looking traction engine seen in Fig. 49 was produced using

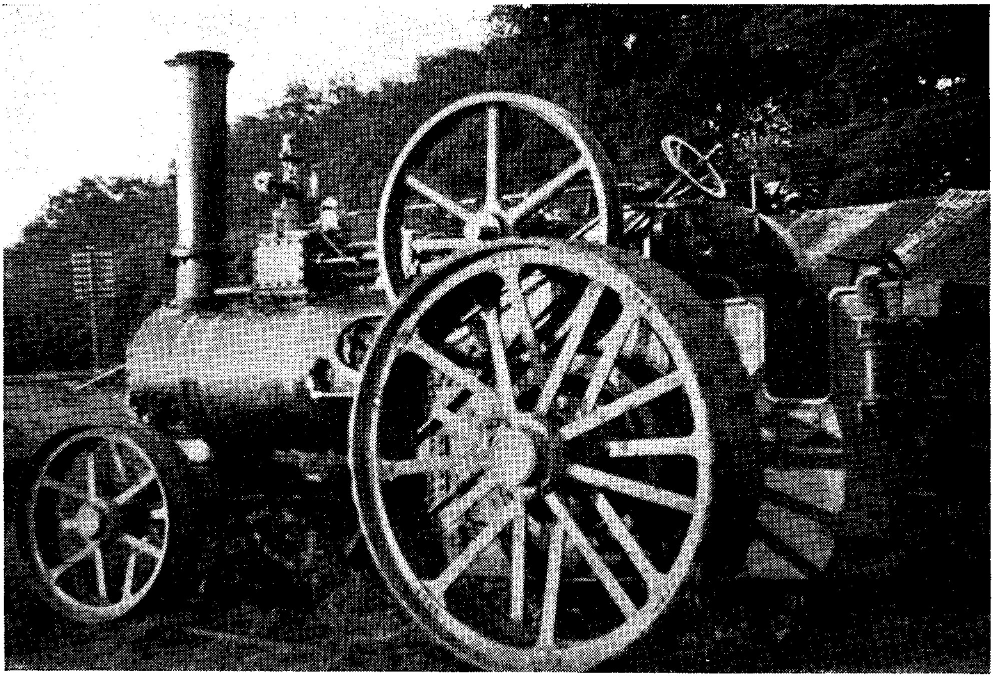


Fig. 48. *The last Savage traction engine—No.* 864

the same design of cylinder and slide-bars as were used on the engine just mentioned above. Note that the hornplates are short in length, with the crankshaft and its cannon brackets mounted on the top centre of them, thus bringing the flywheel well back enabling the belt to be taken off behind as well as in front—a useful consideration sometimes saving much manoeuvring when the engine has to be lined up with the thresher in a " sticky " position. The drive to the back axle was by gears in the usual way on the offside.

The front of the engine is just as interesting as the rear, and first of all, notice the chimney base formed of a kind of saddle to embrace the whole upper half of the smokebox. The chimney is very ugly and, although of the " stovepipe " family, could have been enhanced by being made tapering. On either side of the smokebox there extended downwards, tangentially, a side-plate, rather similar to inverted hornplates and on these was mounted a pivot bearing housing and in each of which there turned a front wheel, clearly seen in Fig. 49. Steerage was by means of a rod to each stub axle leading backwards and each rod was united to the other at the after end by a short length of link chain running half way round a pulley suitably grooved to take it. This pulley was in turn mounted on a vertical shaft carrying a handwheel at the top of the tender. To steer, the steersman performed this delicate operation, as one can see, by sitting with one leg inside and the other leg outside the tender. The trick in keeping a straight course was to keep the inside edges of the rear and front wheel rims in line with the eye, and as these inside edges were of the same gauge, then, in theory, the engine would describe a straight line. It often did ! It is unusual to find a feed-pump on the left-hand side of the barrel and also an extra pulley mounted on the flywheel spokes ; but possibly this was a later fitting by its owner, after it had left the works. With an extra large flywheel and front road wheels these engines were steady runners at all times.

(*To be continued*)

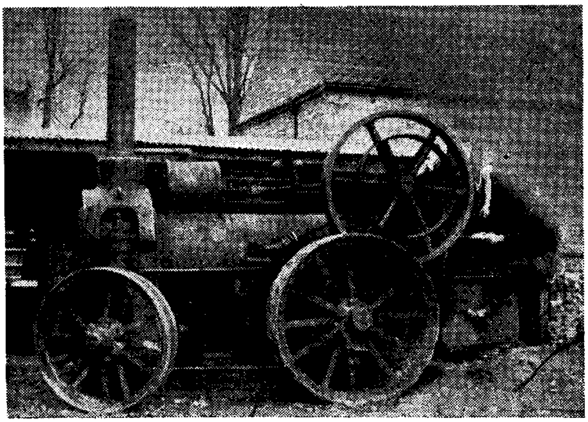


Fig. 49. *An interesting traction engine by W. Tuxford & Sons, of Boston*